T06820 "h2ET060

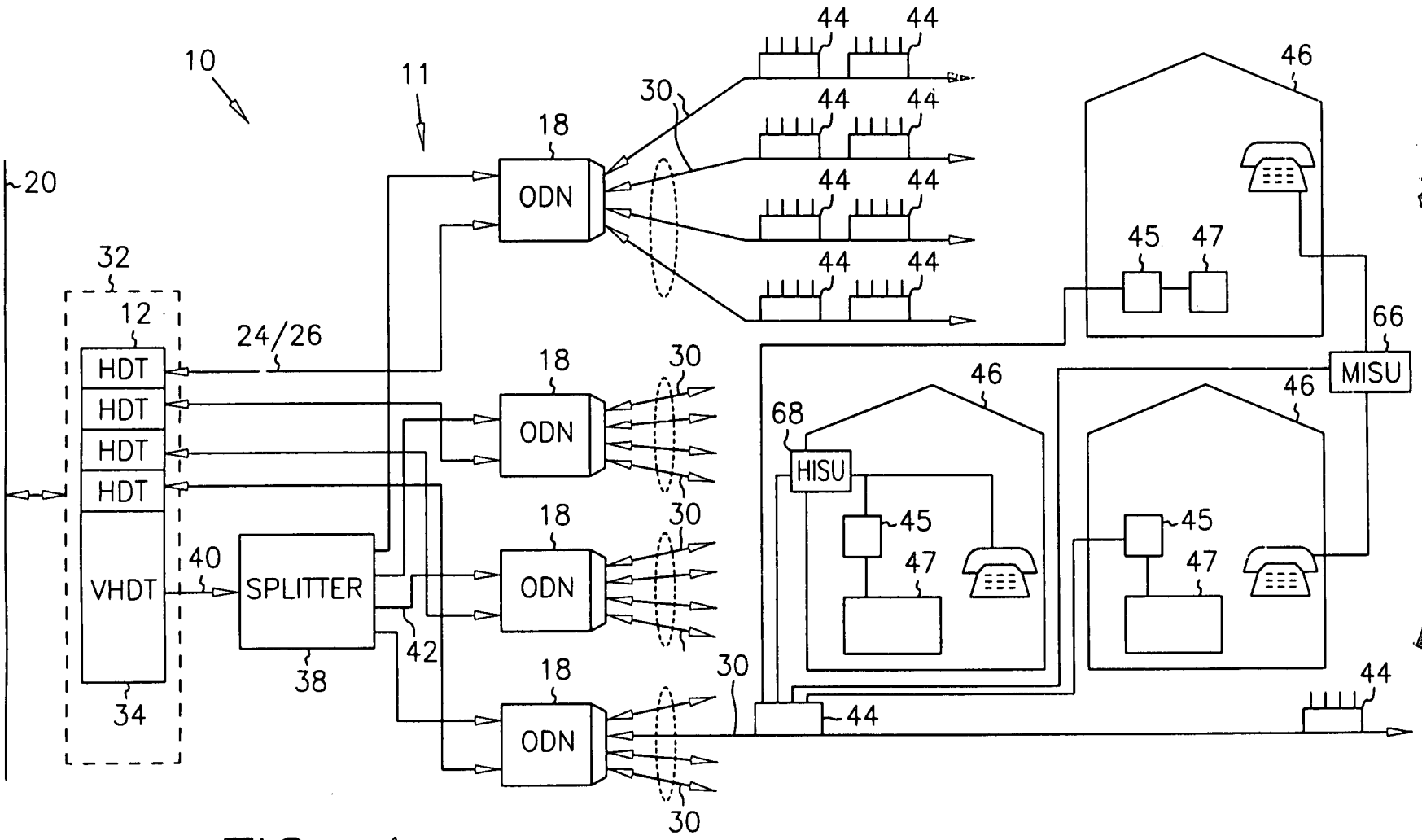


FIG. 1

TO6020 "62T0860

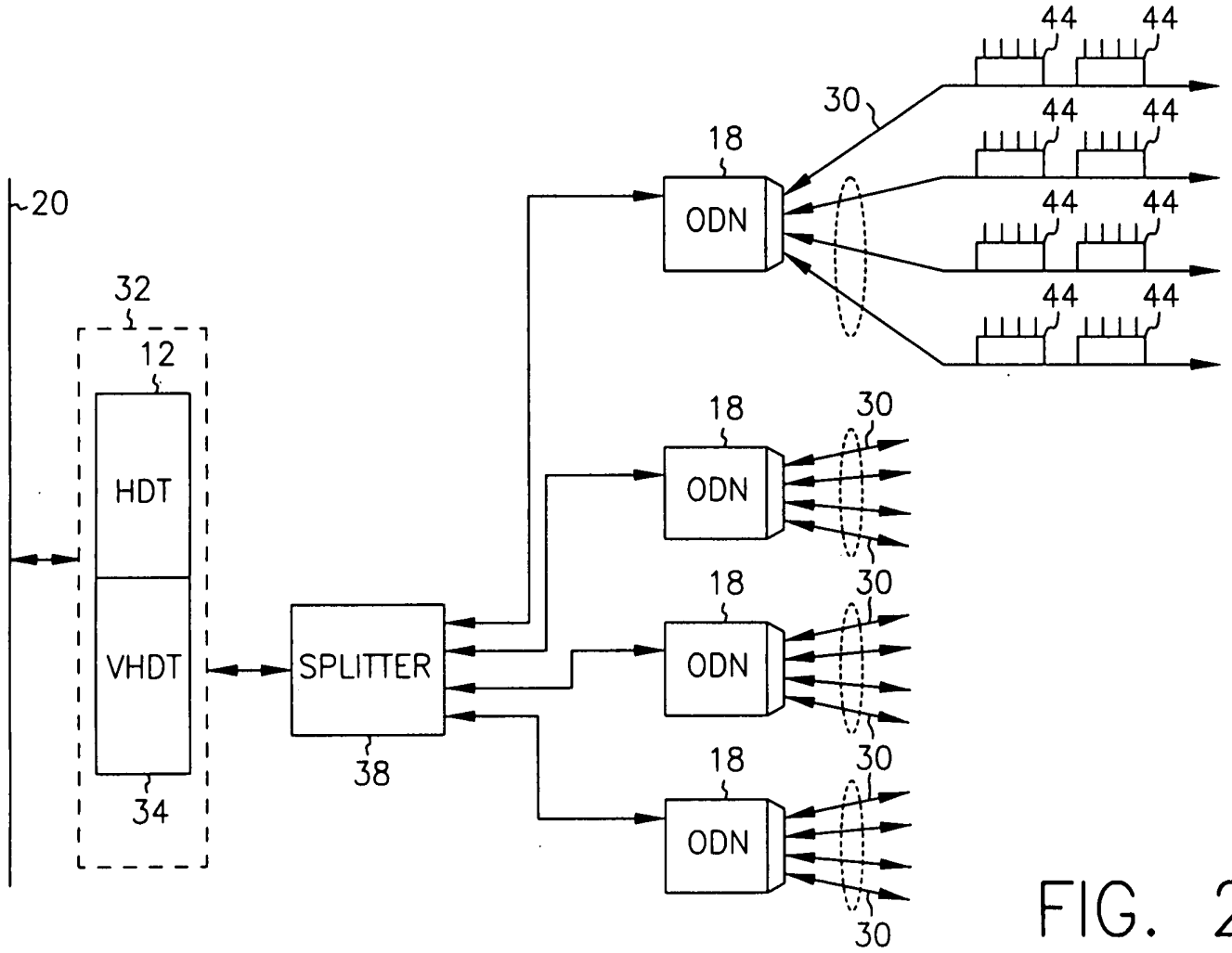


FIG. 2

T06020 "nZET0660

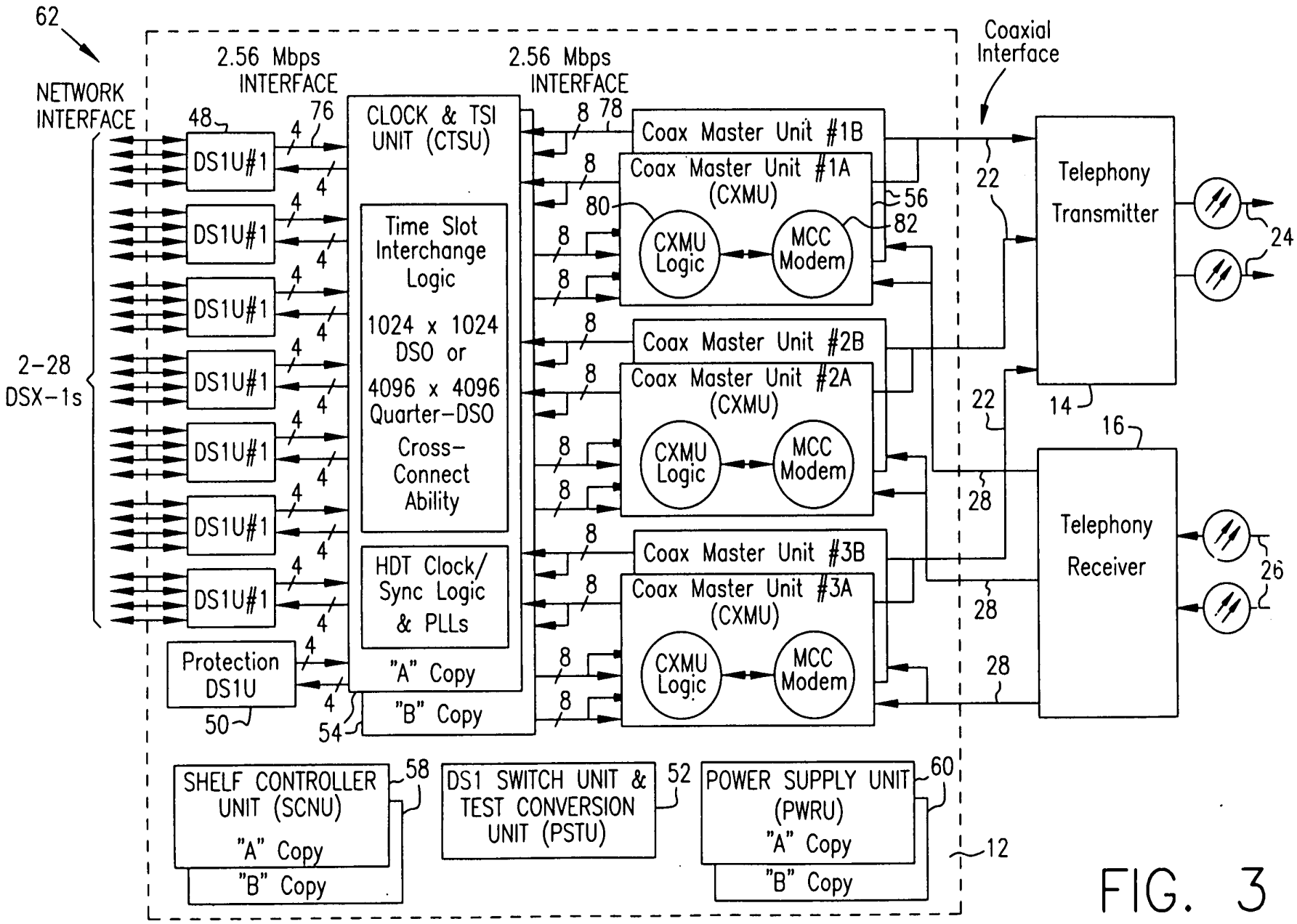
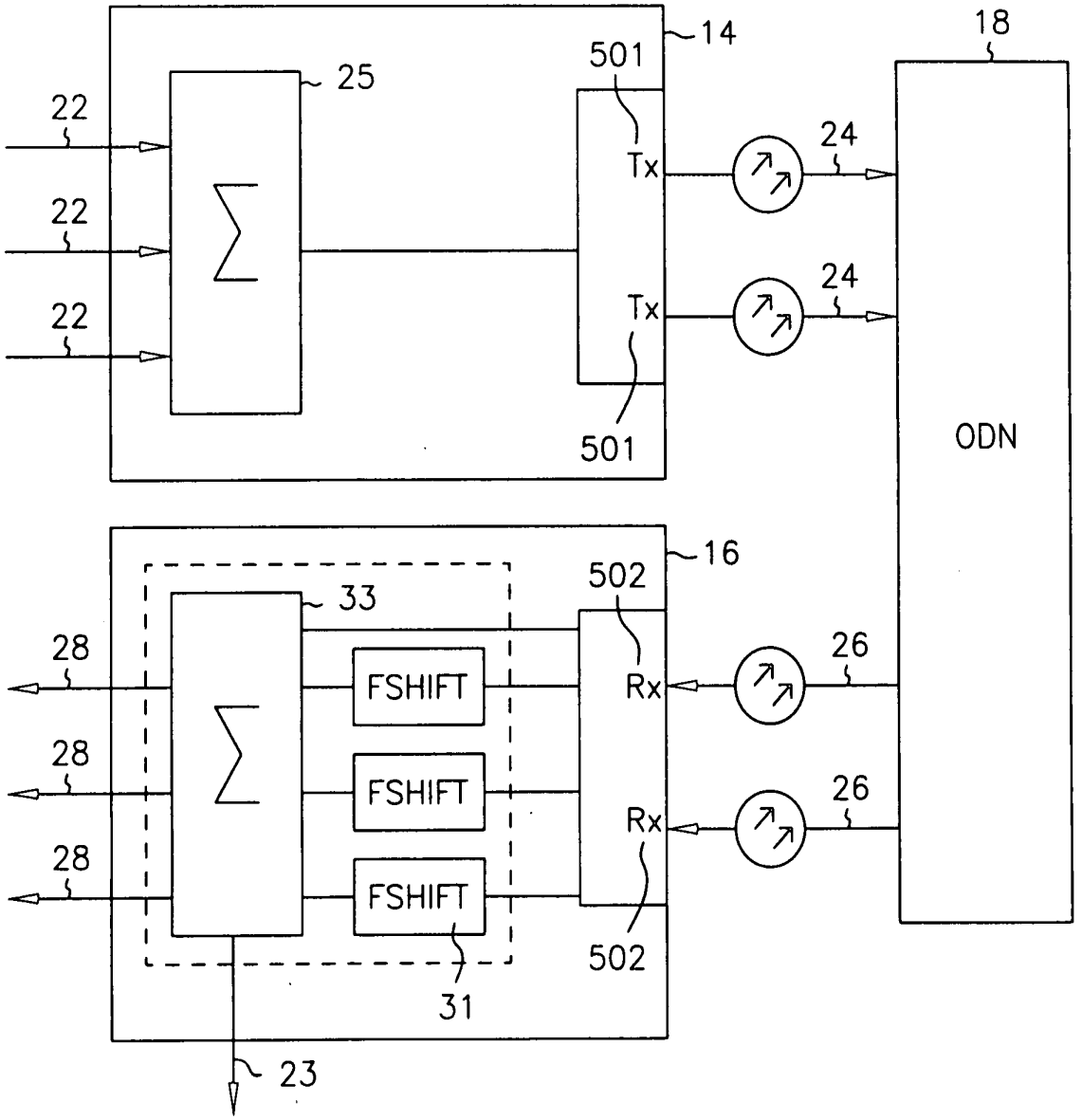


FIG. 3

TO6020 "h2ET0660

FIG. 4



TD6020"tZETD660

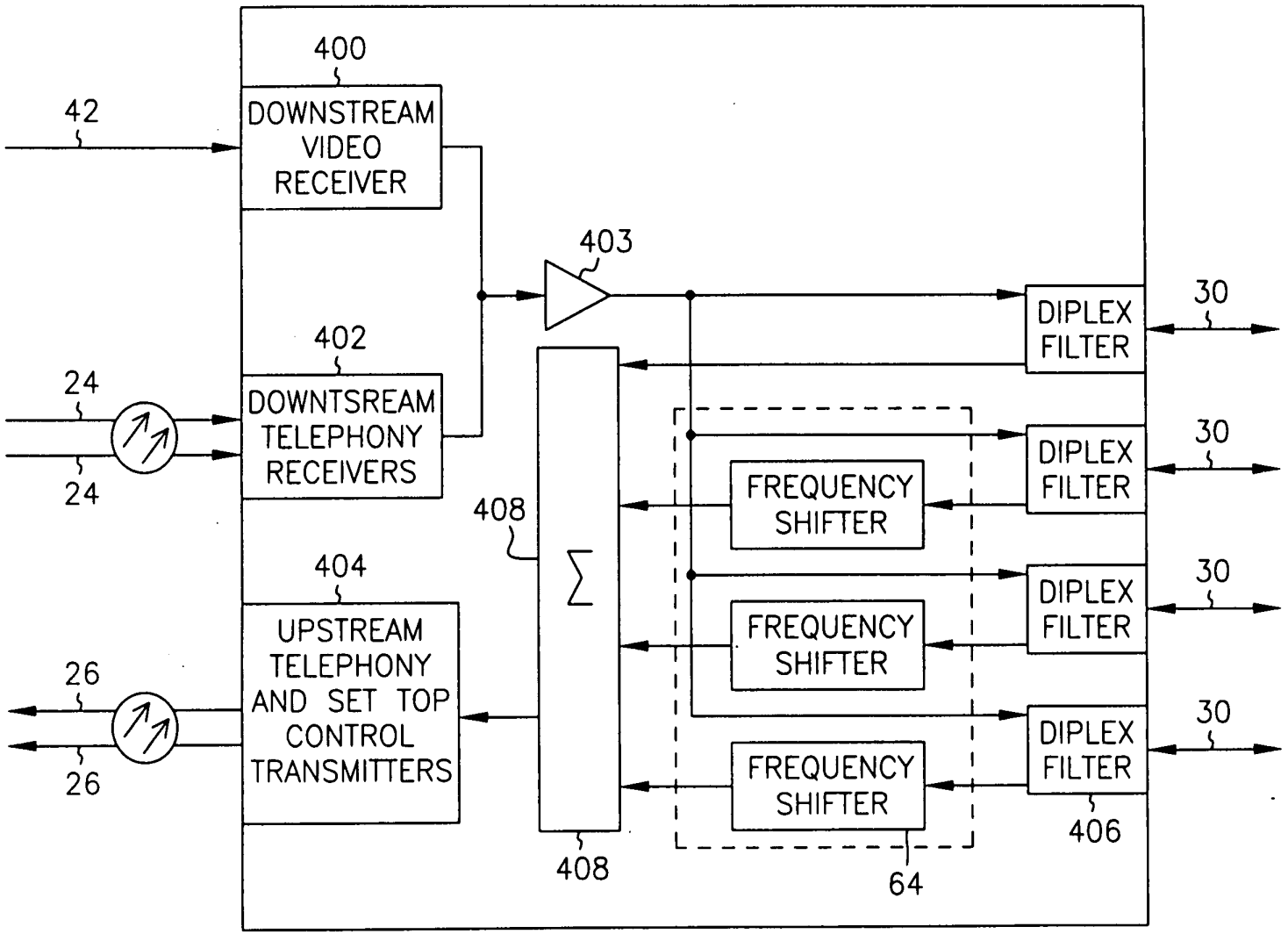


FIG. 5

T0020"tZ2T060

FIG. 6

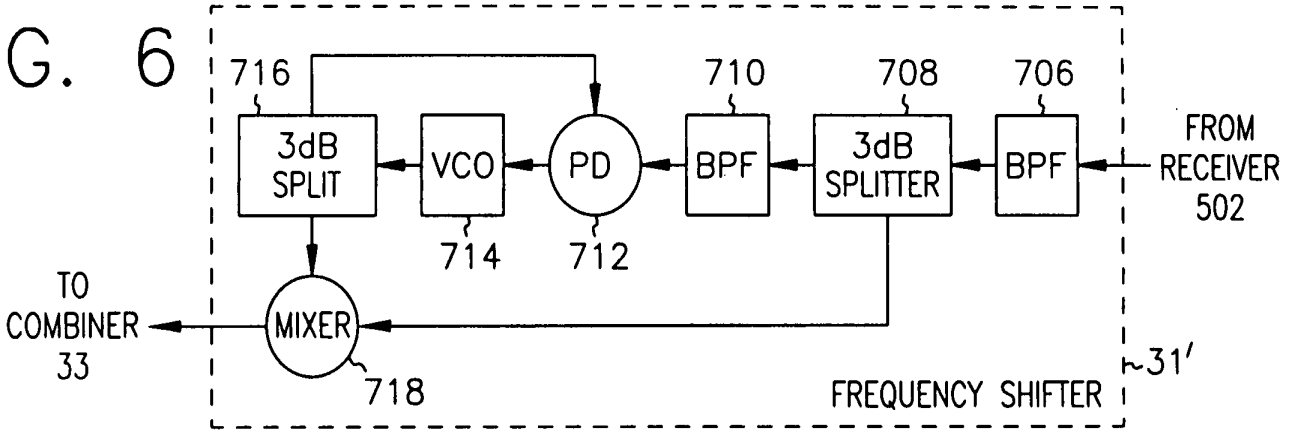
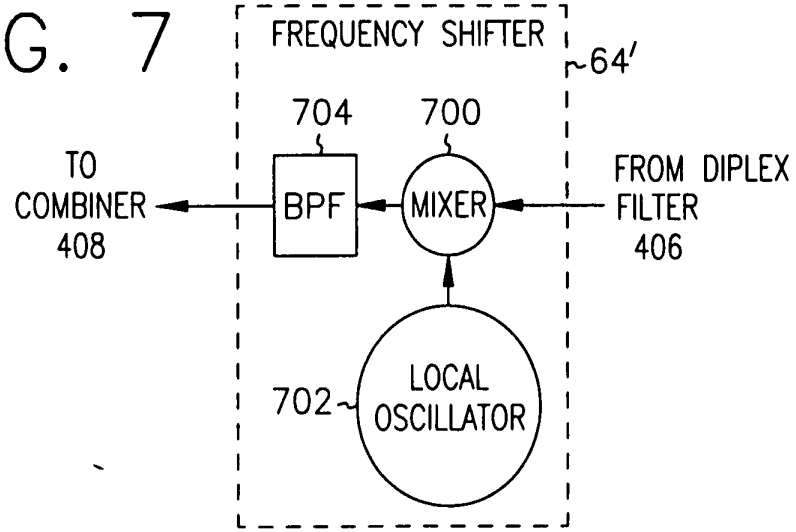


FIG. 7



T06020"h2ET0660

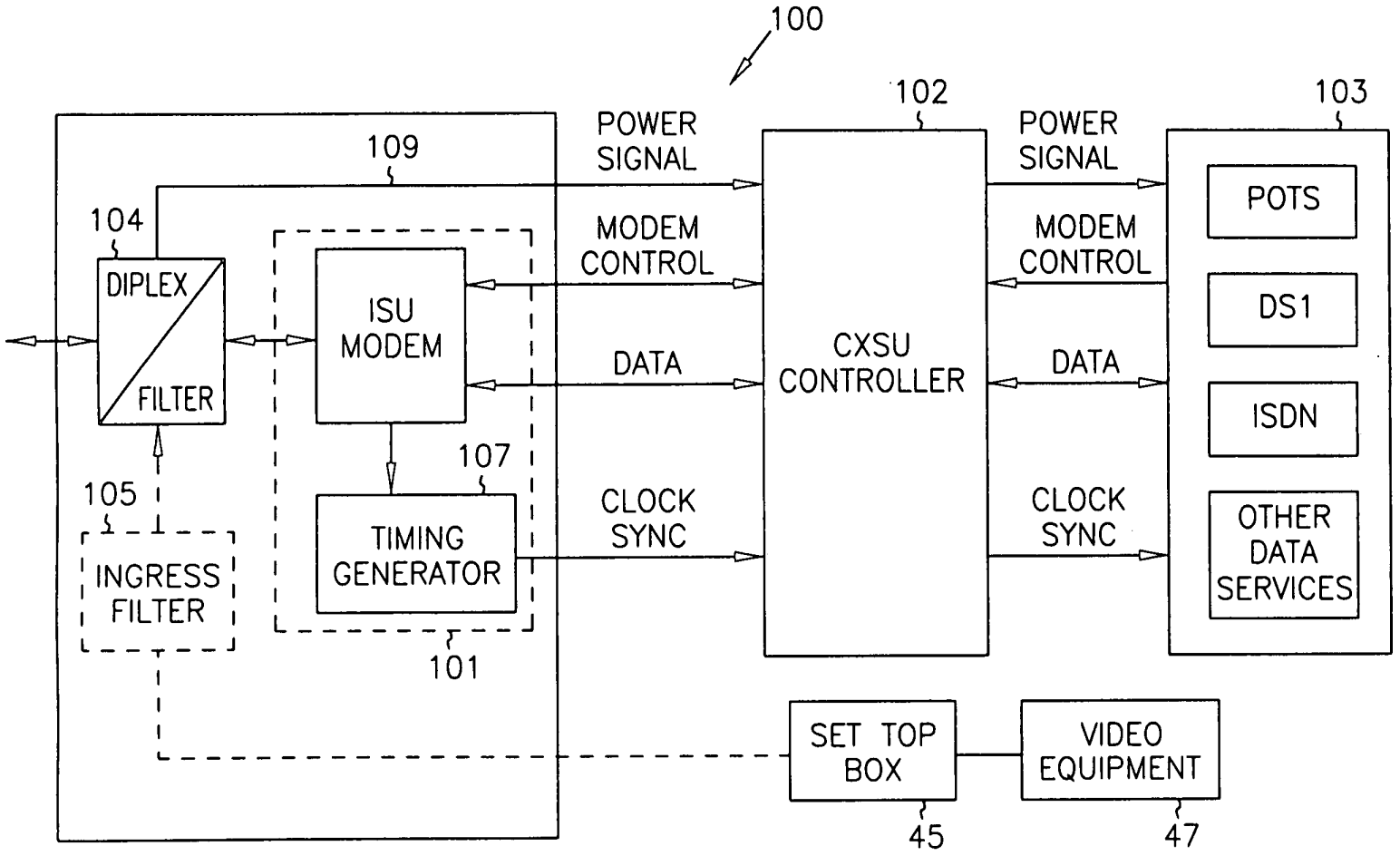


FIG. 8

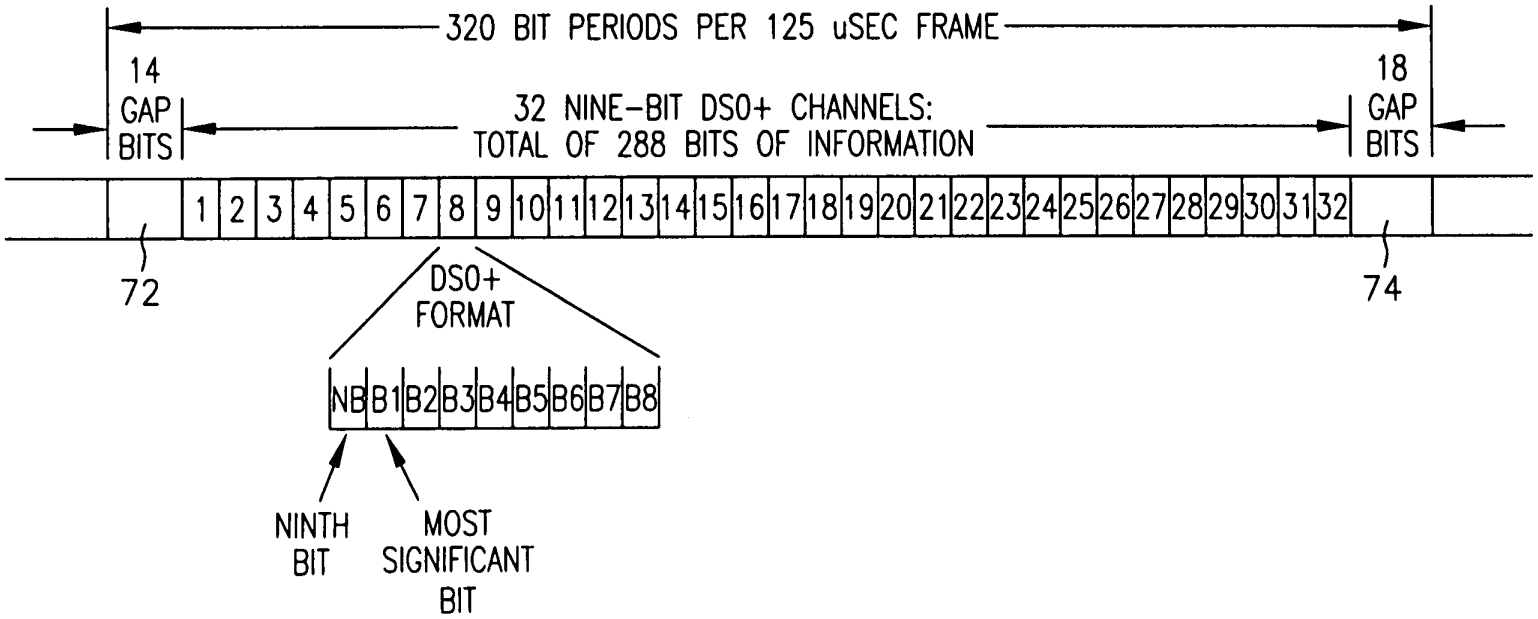

320 BIT PERIODS PER 125 uSEC FRAME
14 GAP BITS
32 NINE-BIT DS0+ CHANNELS: TOTAL OF 288 BITS OF INFORMATION
18 GAP BITS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
72
74
DS0+ FORMAT
NB B1 B2 B3 B4 B5 B6 B7 B8
NINTH BIT
MOST SIGNIFICANT BIT

FIG. 9

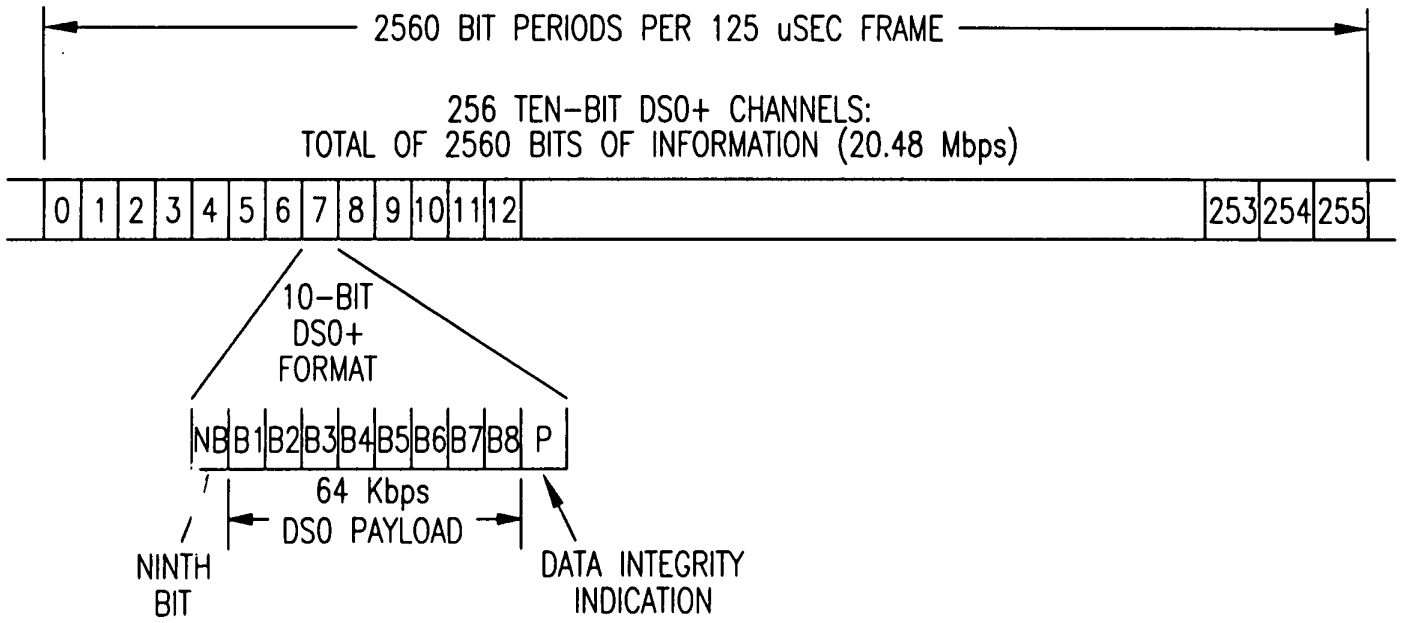

2560 BIT PERIODS PER 125 uSEC FRAME
256 TEN-BIT DS0+ CHANNELS:
TOTAL OF 2560 BITS OF INFORMATION (20.48 Mbps)
0 1 2 3 4 5 6 7 8 9 10 11 12 253 254 255
10-BIT
DS0+
FORMAT
NB B1 B2 B3 B4 B5 B6 B7 B8 P
64 Kbps
DS0 PAYLOAD
NINTH
BIT
DATA INTEGRITY
INDICATION

FIG. 10

T06020 "ACT0060

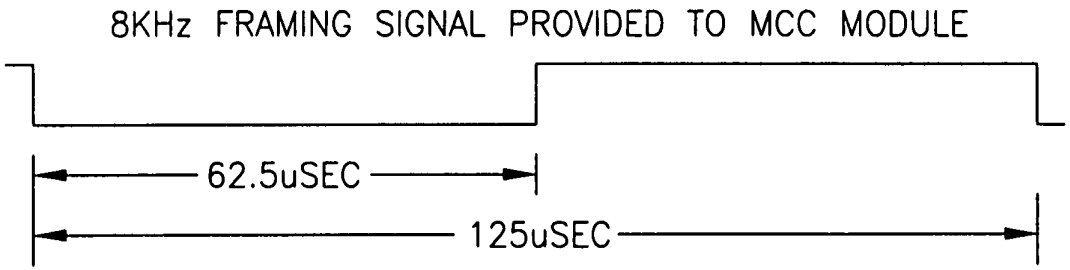


FIG. 11

T06020 "h2ET0660

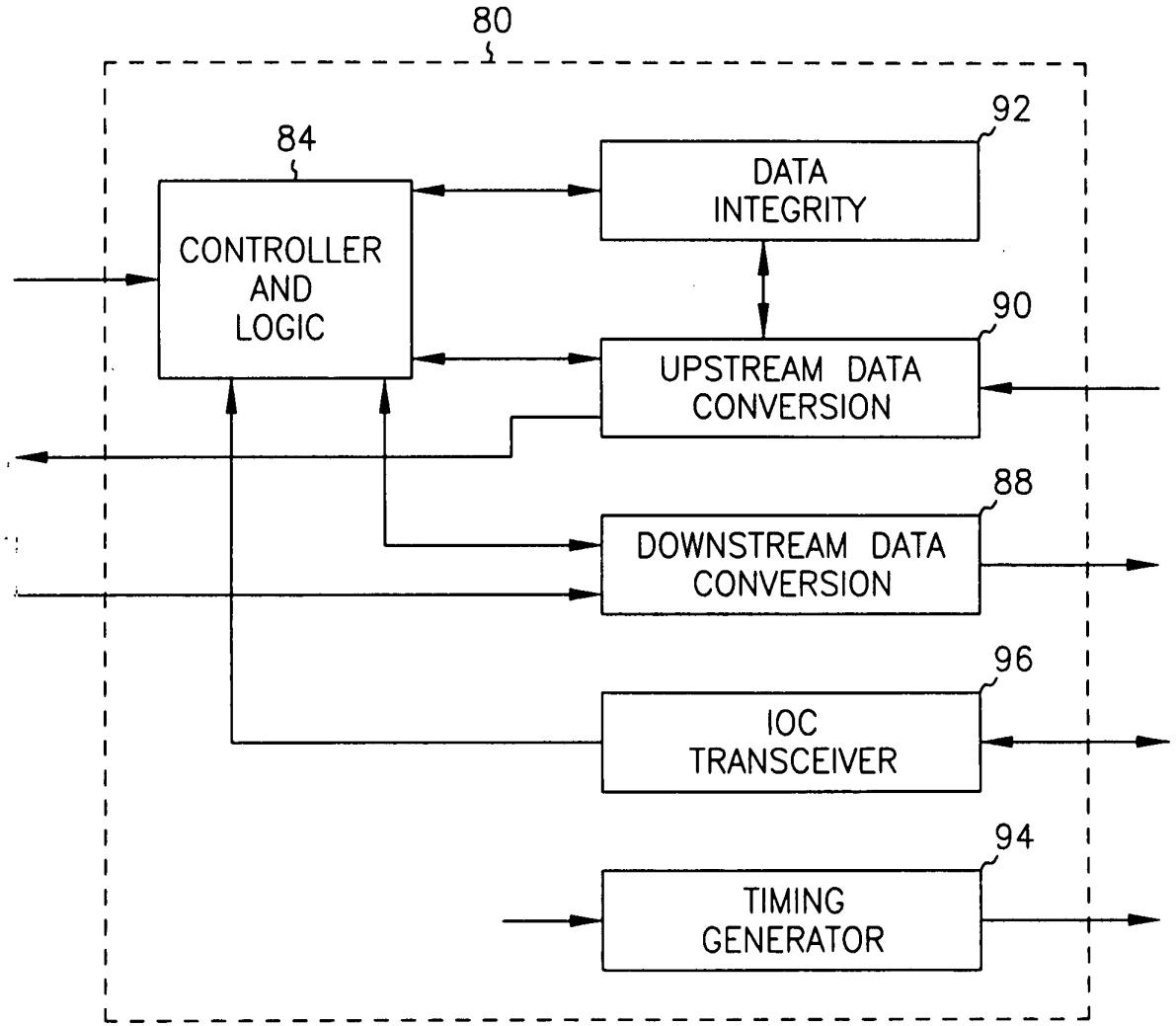


FIG. 12

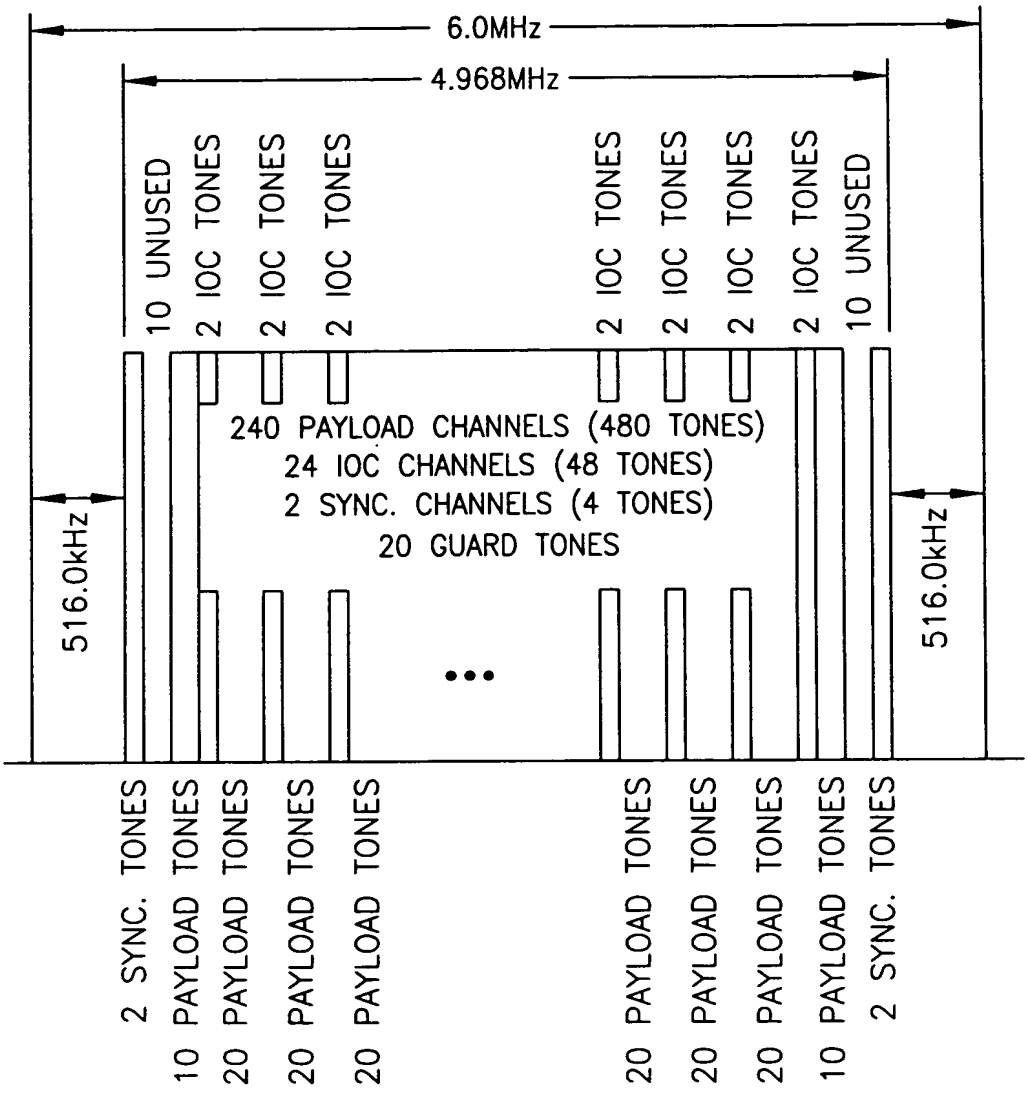

6.0MHz
4.968MHz
10 UNUSED
2 IOC TONES
2 IOC TONES
2 IOC TONES
2 IOC TONES
2 IOC TONES
2 IOC TONES
2 IOC TONES
10 UNUSED
240 PAYLOAD CHANNELS (480 TONES)
24 IOC CHANNELS (48 TONES)
2 SYNC. CHANNELS (4 TONES)
20 GUARD TONES
516.0kHz
516.0kHz
2 SYNC. TONES
10 PAYLOAD TONES
20 PAYLOAD TONES
20 PAYLOAD TONES
20 PAYLOAD TONES
20 PAYLOAD TONES
20 PAYLOAD TONES
20 PAYLOAD TONES
10 PAYLOAD TONES
2 SYNC. TONES

FIG. 13

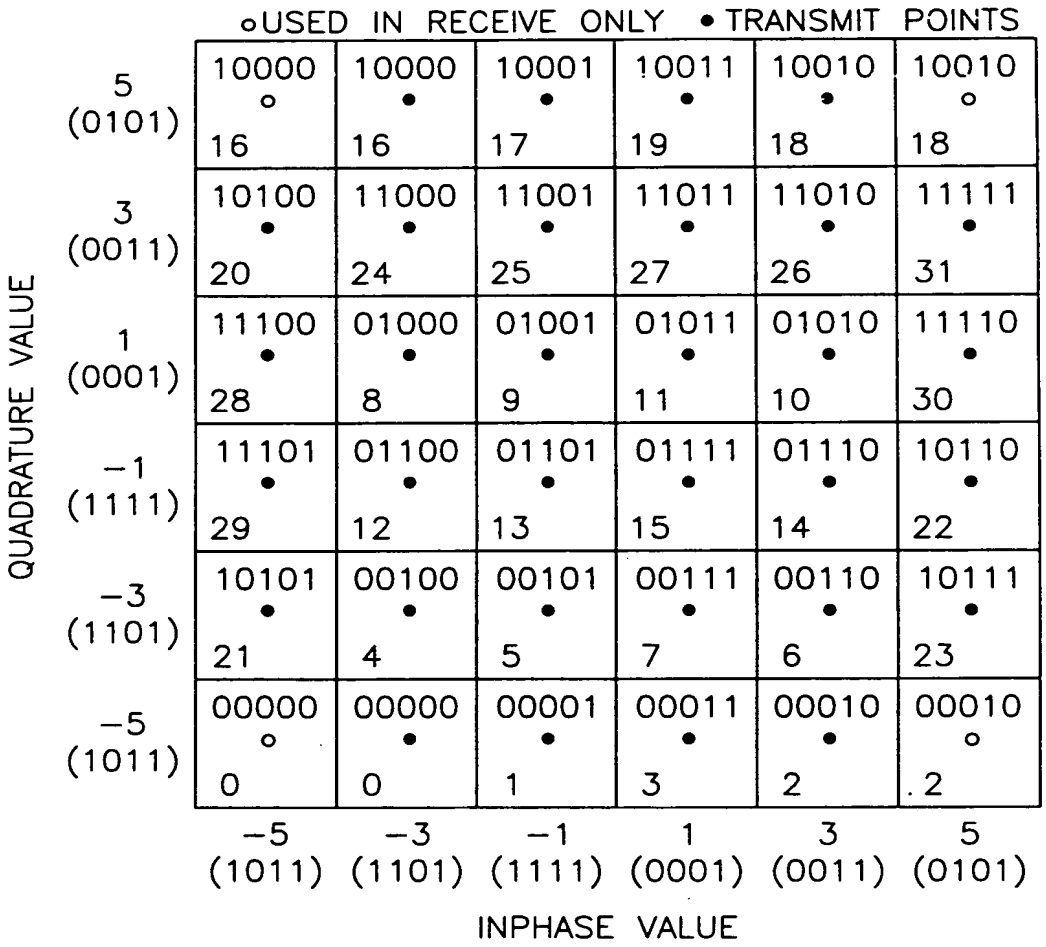

o USED IN RECEIVE ONLY • TRANSMIT POINTS
QUADRATURE VALUE
5 (0101)
3 (0011)
1 (0001)
−1 (1111)
−3 (1101)
−5 (1011)
10000 16 | 10000 16 | 10001 17 | 10011 19 | 10010 18 | 10010 18
10100 20 | 11000 24 | 11001 25 | 11011 27 | 11010 26 | 11111 31
11100 28 | 01000 8 | 01001 9 | 01011 11 | 01010 10 | 11110 30
11101 29 | 01100 12 | 01101 13 | 01111 15 | 01110 14 | 10110 22
10101 21 | 00100 4 | 00101 5 | 00111 7 | 00110 6 | 10111 23
00000 0 | 00000 0 | 00001 1 | 00011 3 | 00010 2 | 00010 2
−5 (1011) −3 (1101) −1 (1111) 1 (0001) 3 (0011) 5 (0101)
INPHASE VALUE

FIG. 14

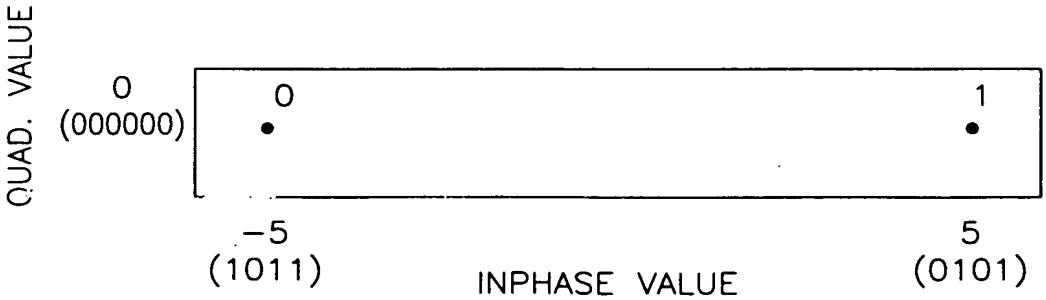

QUAD. VALUE
0 (000000)
0
1
−5 (1011)
5 (0101)
INPHASE VALUE

FIG. 15

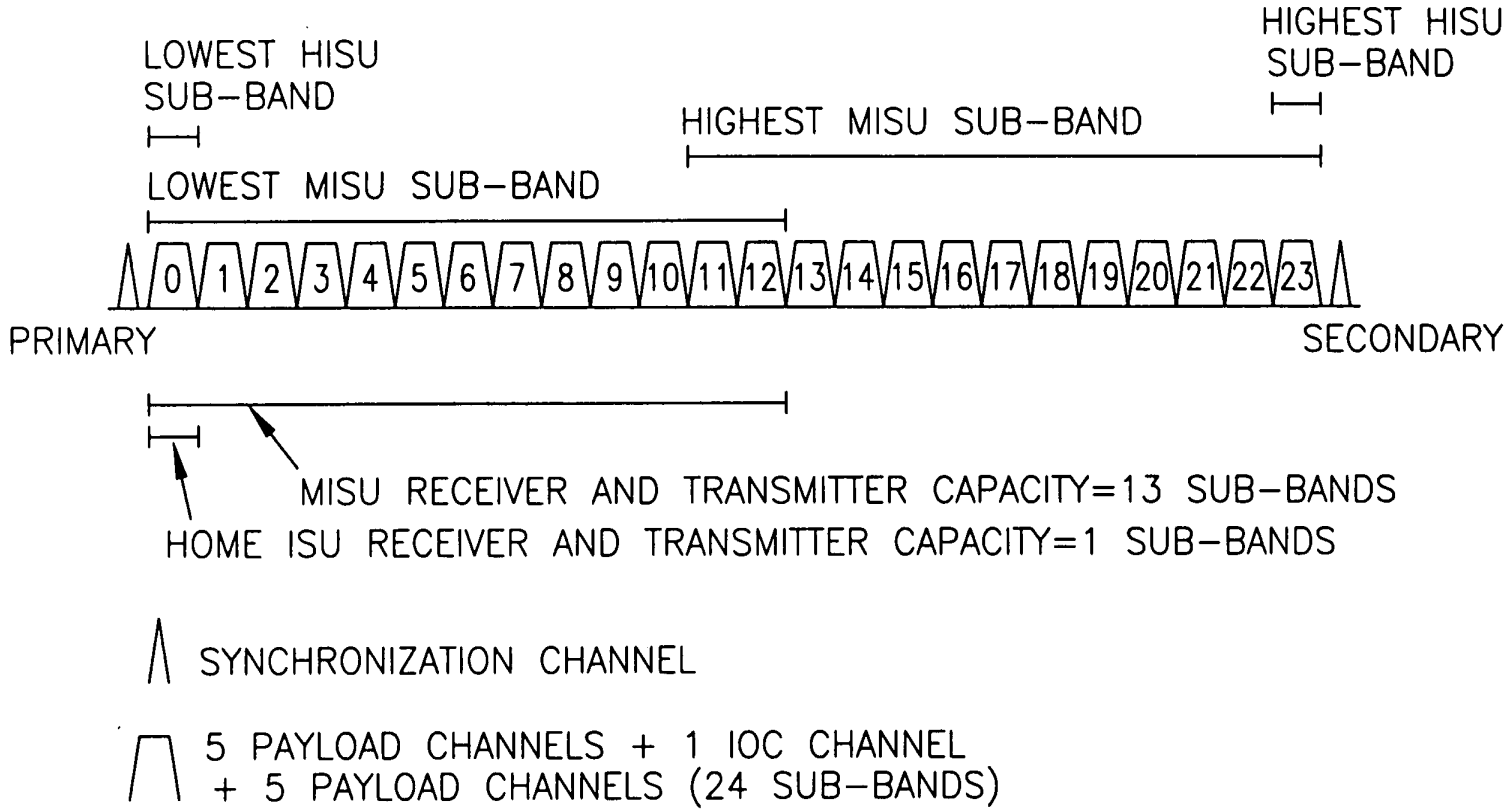

LOWEST HISU
SUB-BAND
HIGHEST HISU
SUB-BAND
HIGHEST MISU SUB-BAND
LOWEST MISU SUB-BAND
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
PRIMARY
SECONDARY
MISU RECEIVER AND TRANSMITTER CAPACITY=13 SUB-BANDS
HOME ISU RECEIVER AND TRANSMITTER CAPACITY=1 SUB-BANDS
SYNCHRONIZATION CHANNEL
5 PAYLOAD CHANNELS + 1 IOC CHANNEL
+ 5 PAYLOAD CHANNELS (24 SUB-BANDS)

FIG. 16

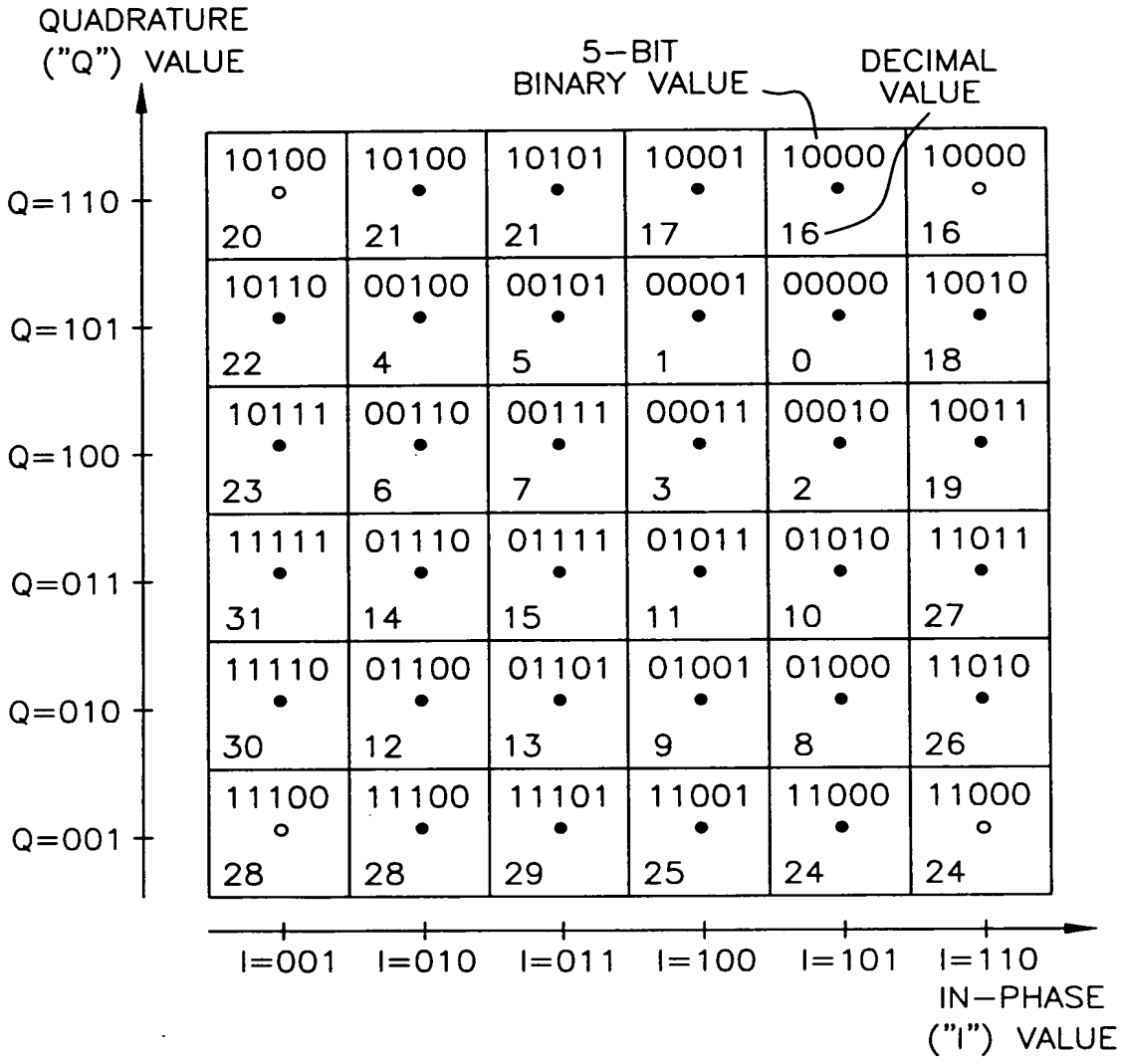

QUADRATURE
("Q") VALUE
5-BIT
BINARY VALUE
DECIMAL
VALUE
Q=110
Q=101
Q=100
Q=011
Q=010
Q=001
10100 20
10100 21
10101 21
10001 17
10000 16
10000 16
10110 22
00100 4
00101 5
00001 1
00000 0
10010 18
10111 23
00110 6
00111 7
00011 3
00010 2
10011 19
11111 31
01110 14
01111 15
01011 11
01010 10
11011 27
11110 30
01100 12
01101 13
01001 9
01000 8
11010 26
11100 28
11100 28
11101 29
11001 25
11000 24
11000 24
I=001
I=010
I=011
I=100
I=101
I=110
IN-PHASE
("I") VALUE

FIG. 17

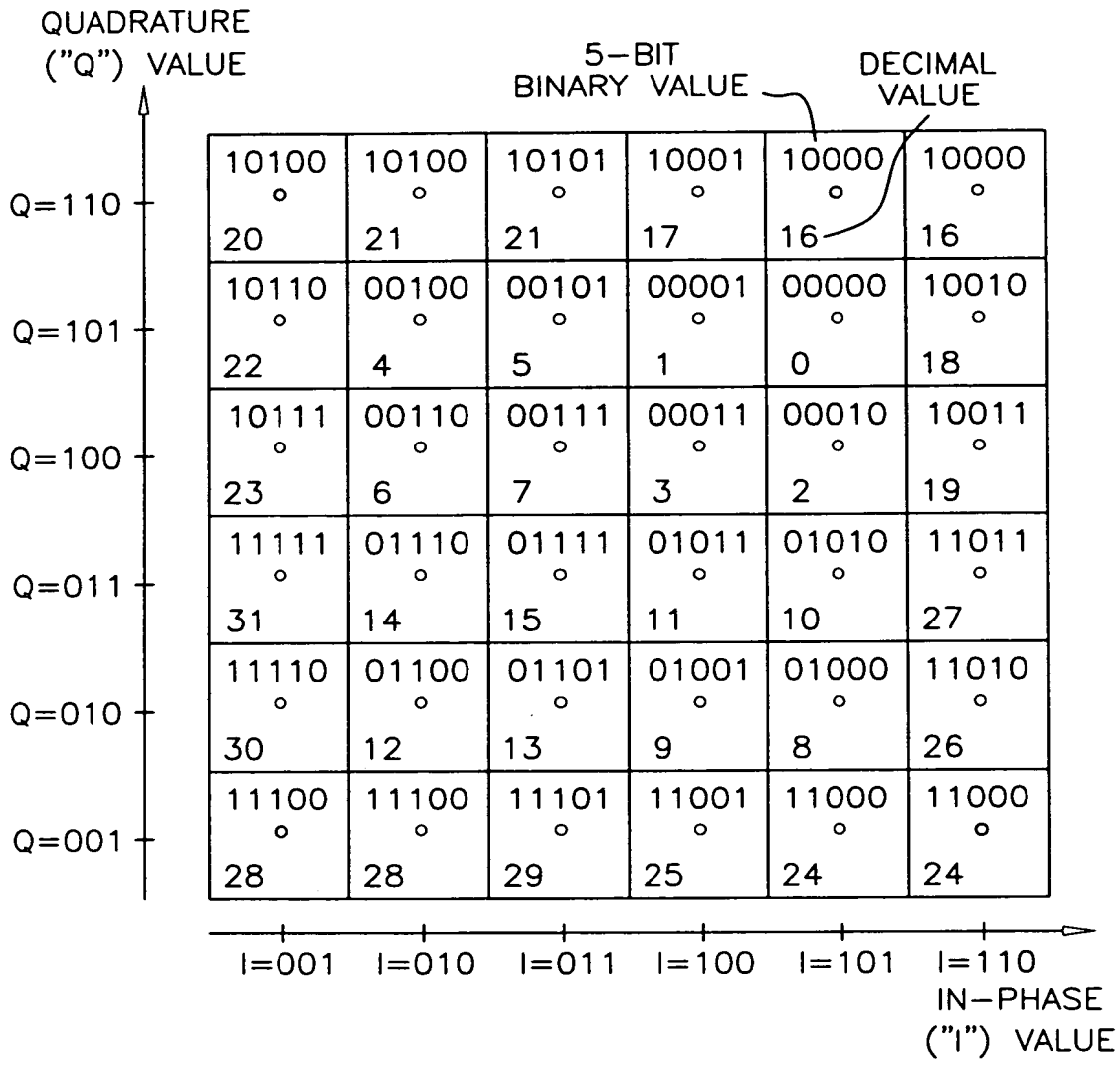

QUADRATURE ("Q") VALUE
5-BIT BINARY VALUE
DECIMAL VALUE
Q=110
Q=101
Q=100
Q=011
Q=010
Q=001
10100 20
10100 21
10101 21
10001 17
10000 16
10000 16
10110 22
00100 4
00101 5
00001 1
00000 0
10010 18
10111 23
00110 6
00111 7
00011 3
00010 2
10011 19
11111 31
01110 14
01111 15
01011 11
01010 10
11011 27
11110 30
01100 12
01101 13
01001 9
01000 8
11010 26
11100 28
11100 28
11101 29
11001 25
11000 24
11000 24
I=001
I=010
I=011
I=100
I=101
I=110
IN-PHASE ("I") VALUE

FIG. 18

T06020"h2ET0660

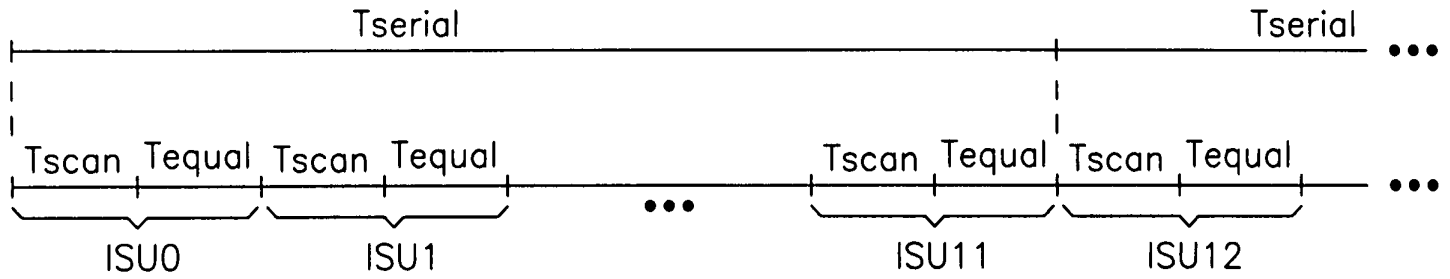


FIG. 19

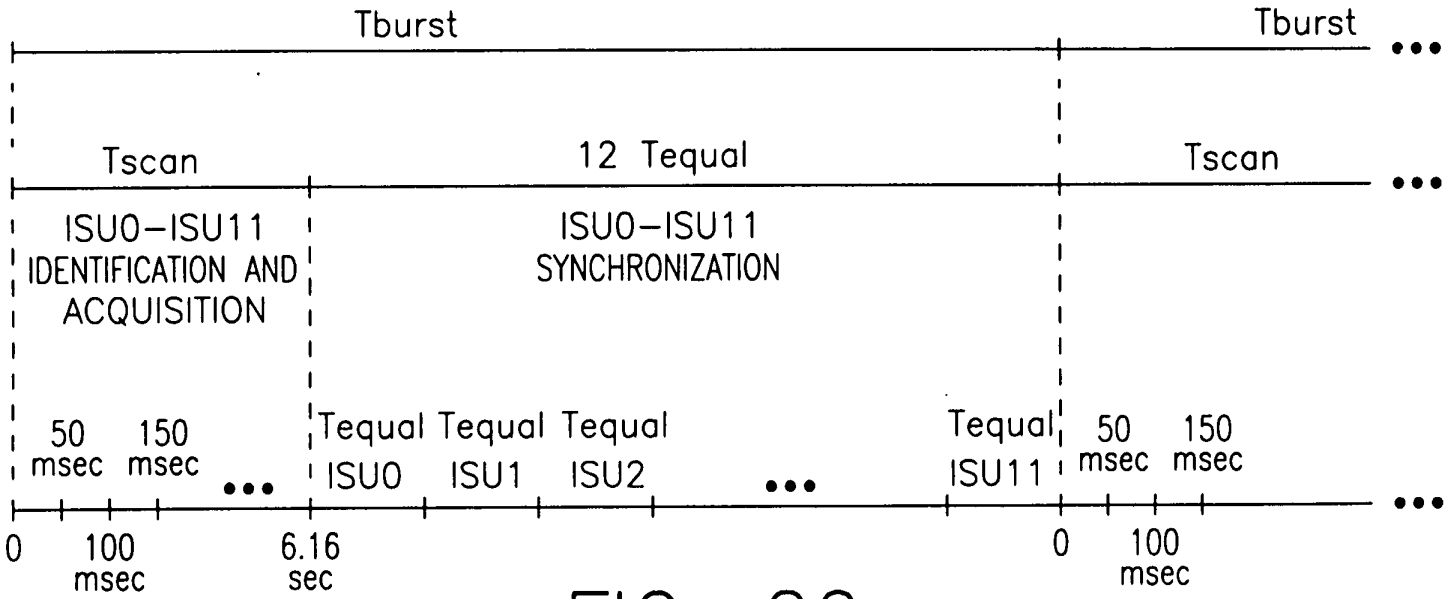


FIG. 20

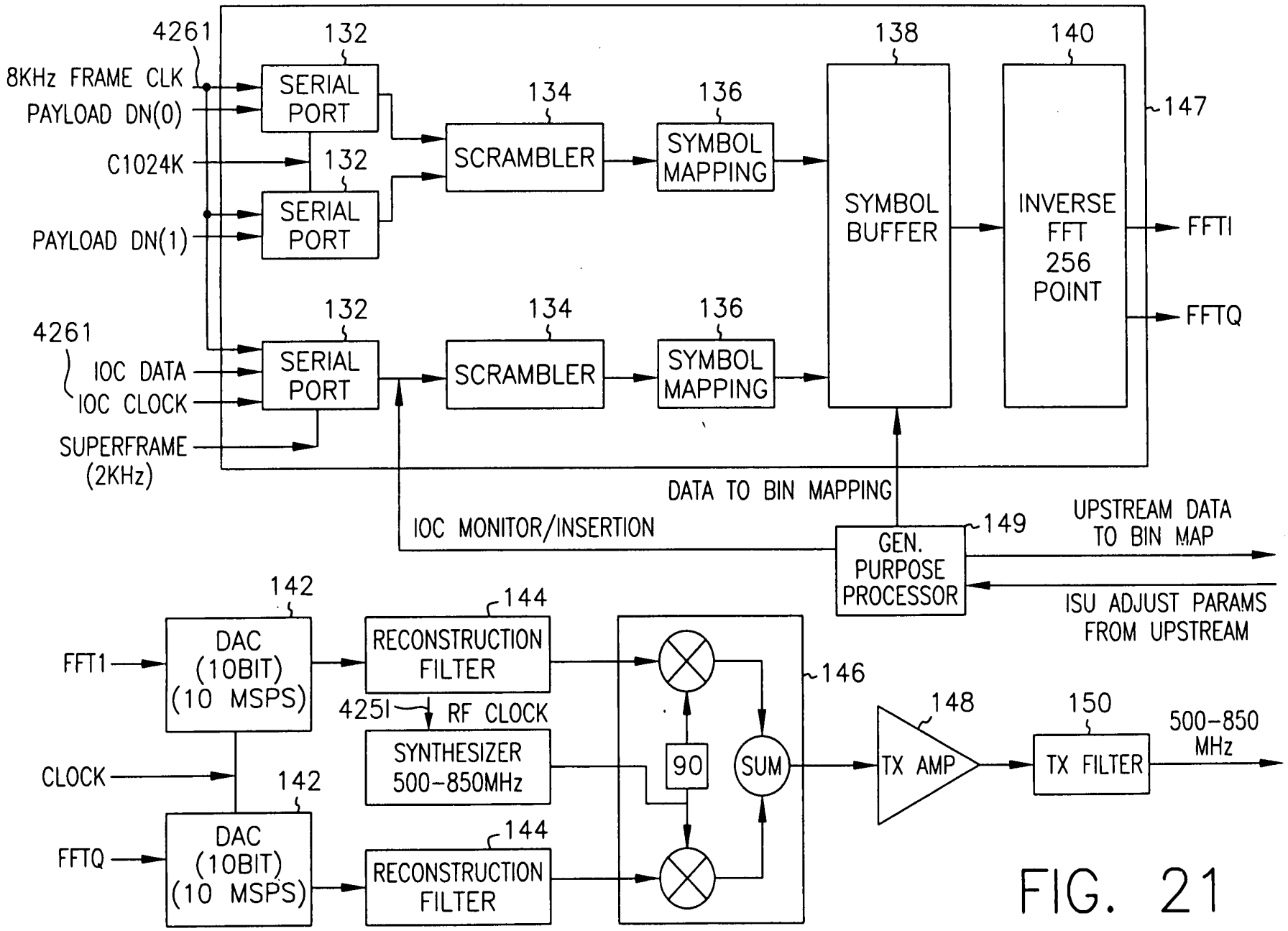

4261
8KHz FRAME CLK
PAYLOAD DN(0)
C1024K
PAYLOAD DN(1)
4261
IOC DATA
IOC CLOCK
SUPERFRAME (2KHz)
132
SERIAL PORT
132
SERIAL PORT
132
SERIAL PORT
134
SCRAMBLER
134
SCRAMBLER
136
SYMBOL MAPPING
136
SYMBOL MAPPING
138
SYMBOL BUFFER
140
INVERSE FFT 256 POINT
147
FFTI
FFTQ
DATA TO BIN MAPPING
IOC MONITOR/INSERTION
GEN. PURPOSE PROCESSOR
149
UPSTREAM DATA TO BIN MAP
ISU ADJUST PARAMS FROM UPSTREAM
142
DAC (10BIT) (10 MSPS)
144
RECONSTRUCTION FILTER
FFT1
4251
RF CLOCK
SYNTHESIZER 500-850MHz
CLOCK
142
DAC (10BIT) (10 MSPS)
144
RECONSTRUCTION FILTER
FFTQ
90
SUM
146
148
TX AMP
150
TX FILTER
500-850 MHz

FIG. 21

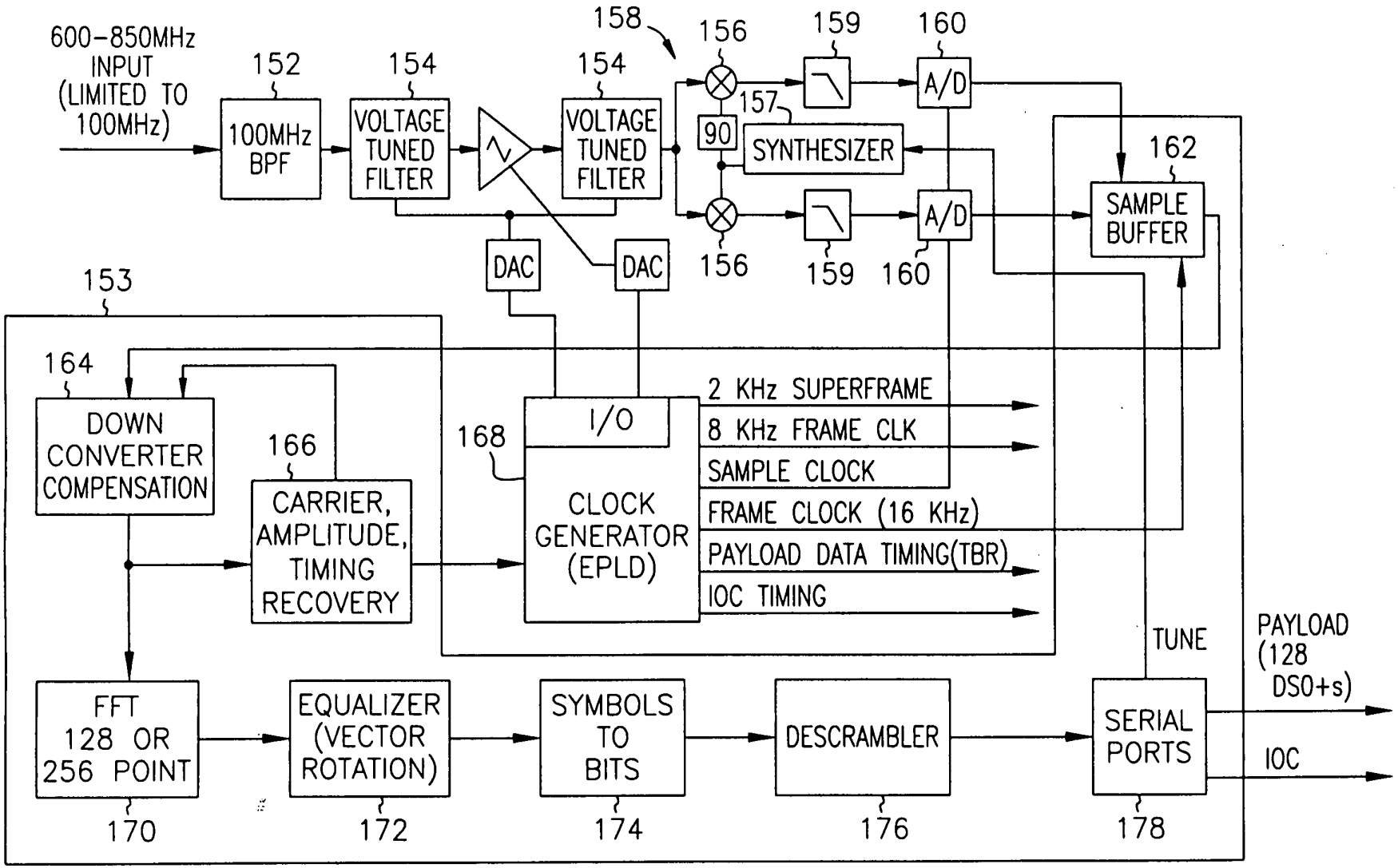

600–850MHz
INPUT
(LIMITED TO
100MHz)
152
100MHz
BPF
154
VOLTAGE
TUNED
FILTER
154
VOLTAGE
TUNED
FILTER
158
156
159
160
A/D
157
90
SYNTHESIZER
A/D
156
159
160
162
SAMPLE
BUFFER
DAC
DAC
153
164
DOWN
CONVERTER
COMPENSATION
166
CARRIER,
AMPLITUDE,
TIMING
RECOVERY
168
I/O
CLOCK
GENERATOR
(EPLD)
2 KHz SUPERFRAME
8 KHz FRAME CLK
SAMPLE CLOCK
FRAME CLOCK (16 KHz)
PAYLOAD DATA TIMING(TBR)
IOC TIMING
TUNE
PAYLOAD
(128
DS0+s)
IOC
FFT
128 OR
256 POINT
170
EQUALIZER
(VECTOR
ROTATION)
172
SYMBOLS
TO
BITS
174
DESCRAMBLER
176
SERIAL
PORTS
178

FIG. 22

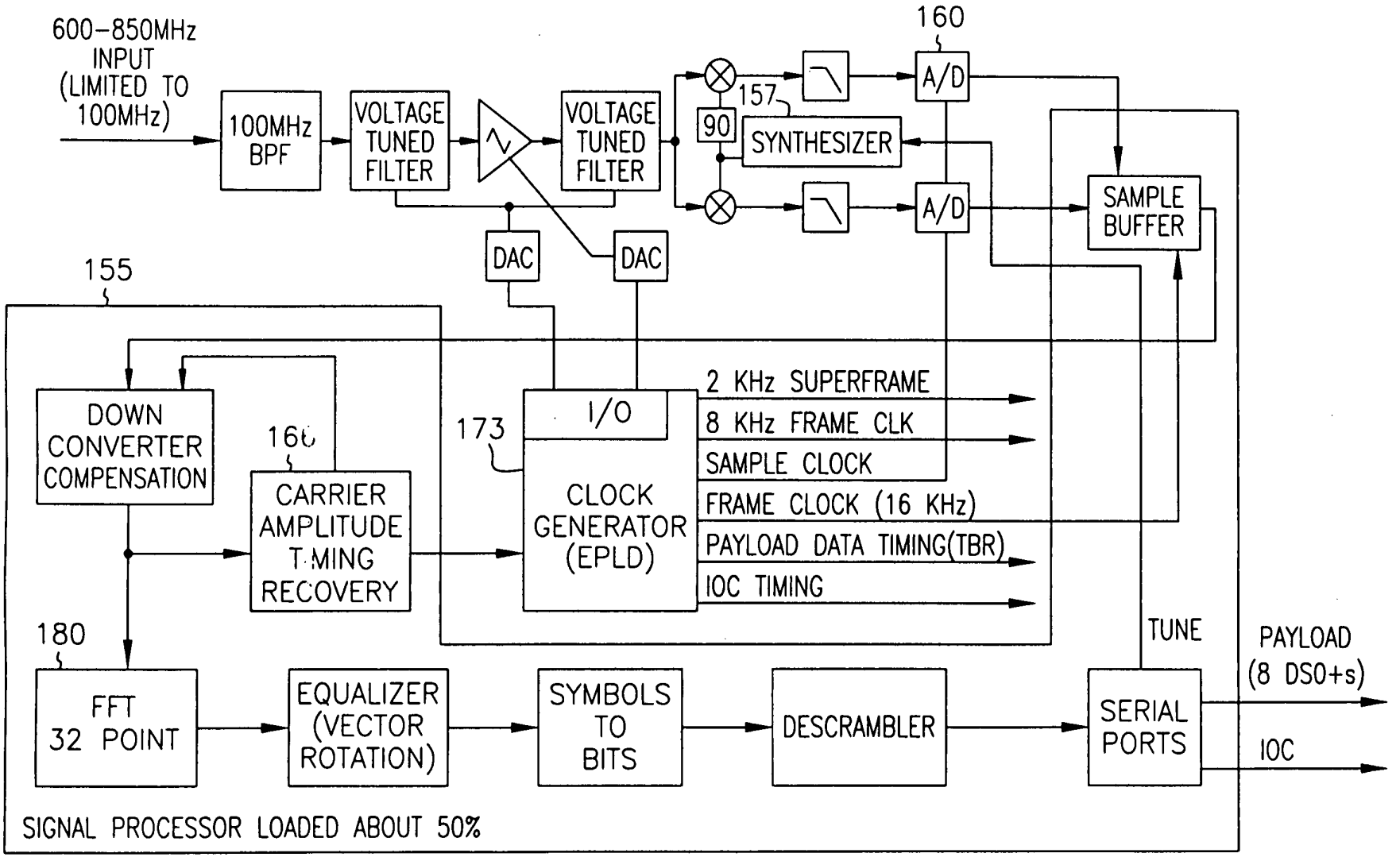

600–850MHz
INPUT
(LIMITED TO
100MHz)
100MHz
BPF
VOLTAGE
TUNED
FILTER
VOLTAGE
TUNED
FILTER
90
157
SYNTHESIZER
160
A/D
A/D
SAMPLE
BUFFER
DAC
DAC
155
DOWN
CONVERTER
COMPENSATION
CARRIER
AMPLITUDE
TIMING
RECOVERY
173
I/O
CLOCK
GENERATOR
(EPLD)
2 KHz SUPERFRAME
8 KHz FRAME CLK
SAMPLE CLOCK
FRAME CLOCK (16 KHz)
PAYLOAD DATA TIMING(TBR)
IOC TIMING
180
FFT
32 POINT
EQUALIZER
(VECTOR
ROTATION)
SYMBOLS
TO
BITS
DESCRAMBLER
SERIAL
PORTS
TUNE
PAYLOAD
(8 DS0+s)
IOC
SIGNAL PROCESSOR LOADED ABOUT 50%

FIG. 23

T06020"A2ET0660

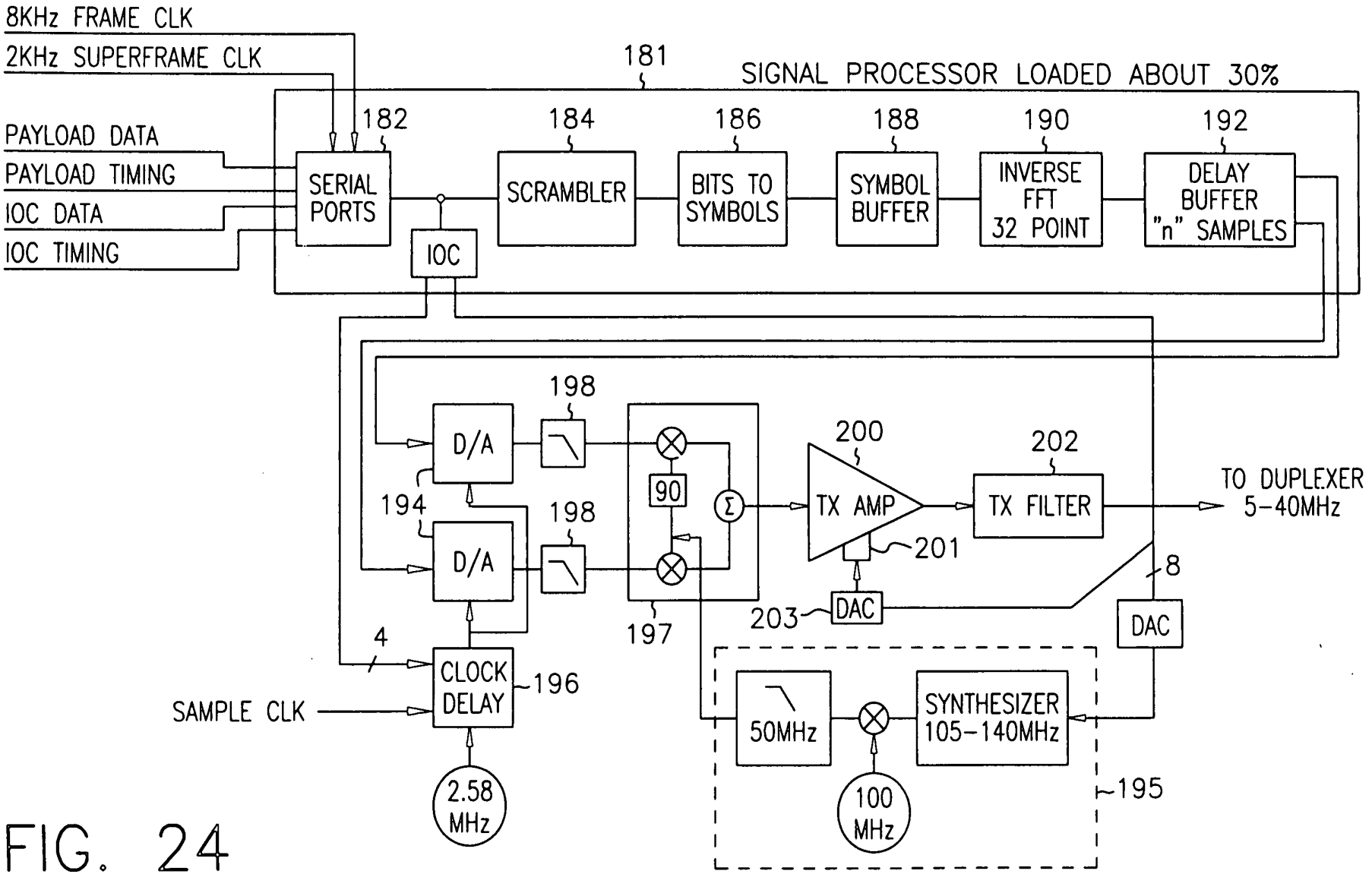


FIG. 24

TD6020 "ZETDEC"

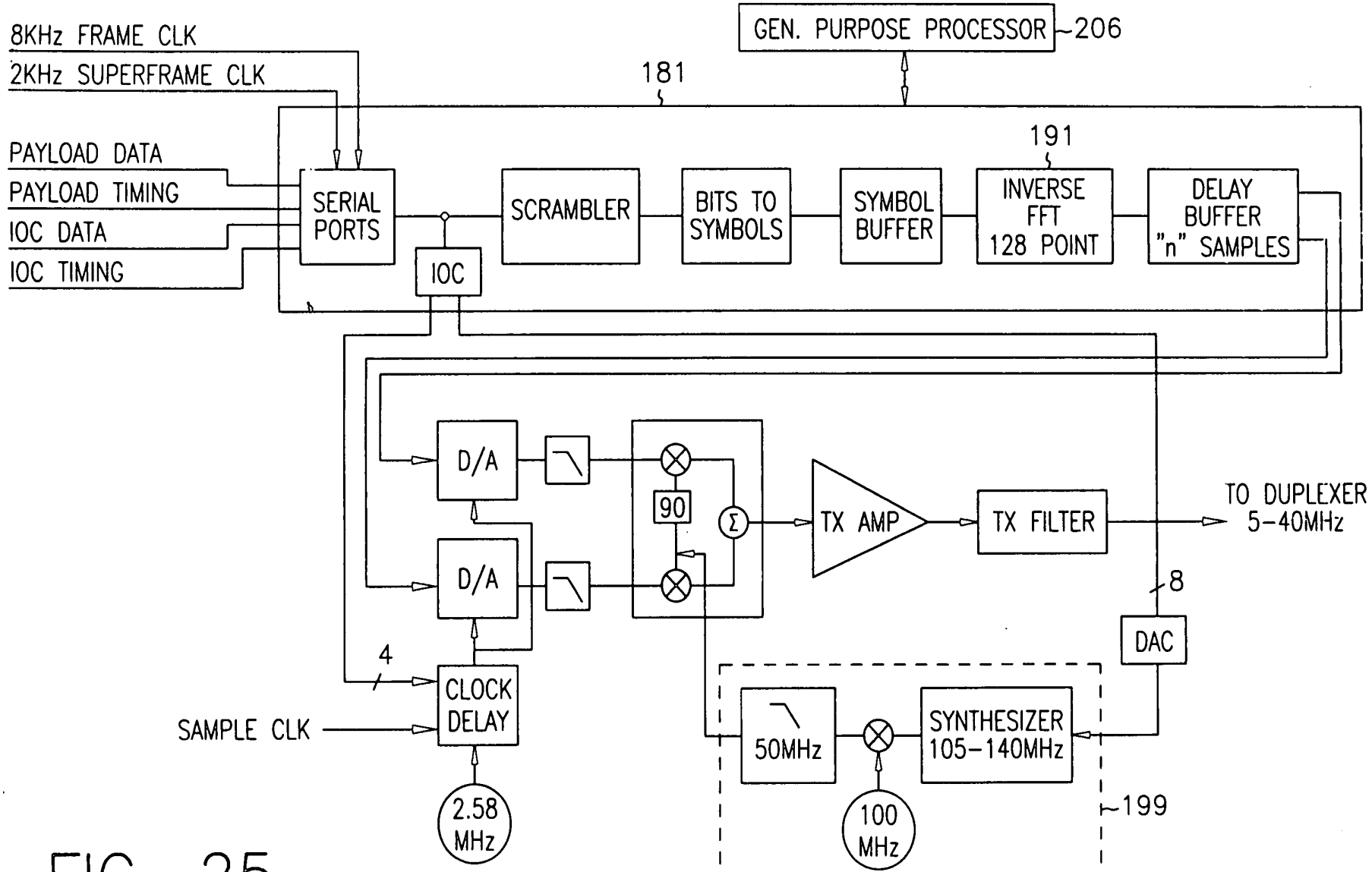


FIG. 25

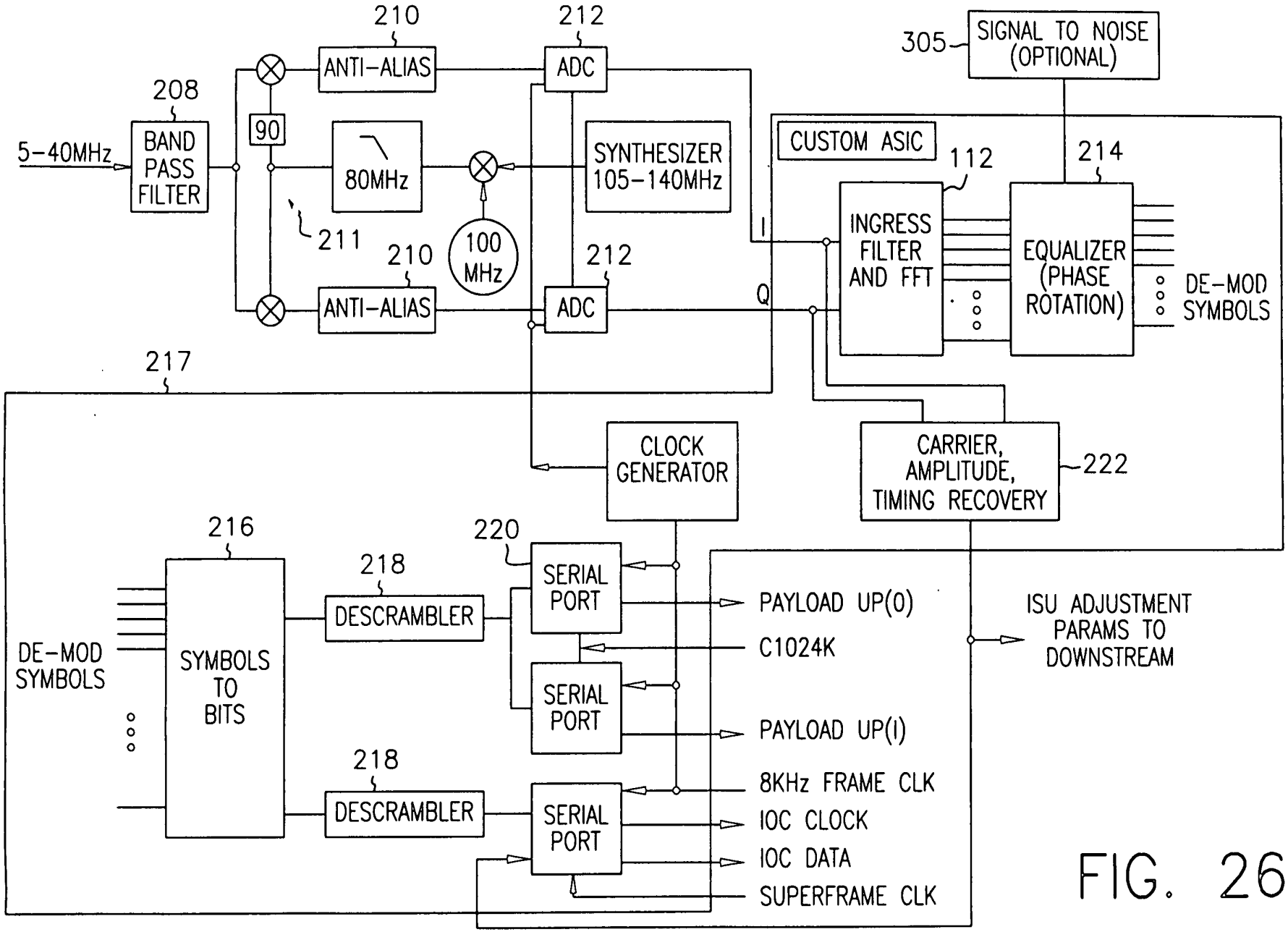

210
212
305
SIGNAL TO NOISE (OPTIONAL)
208
ANTI-ALIAS
ADC
5-40MHz
BAND PASS FILTER
90
80MHz
SYNTHESIZER 105-140MHz
CUSTOM ASIC
112
214
211
210
100 MHz
212
I
INGRESS FILTER AND FFT
EQUALIZER (PHASE ROTATION)
DE-MOD SYMBOLS
ANTI-ALIAS
ADC
Q
217
CLOCK GENERATOR
CARRIER, AMPLITUDE, TIMING RECOVERY
222
216
220
218
SERIAL PORT
PAYLOAD UP(0)
DESCRAMBLER
DE-MOD SYMBOLS
SYMBOLS TO BITS
C1024K
ISU ADJUSTMENT PARAMS TO DOWNSTREAM
SERIAL PORT
PAYLOAD UP(I)
218
8KHz FRAME CLK
DESCRAMBLER
SERIAL PORT
IOC CLOCK
IOC DATA
SUPERFRAME CLK

FIG. 26

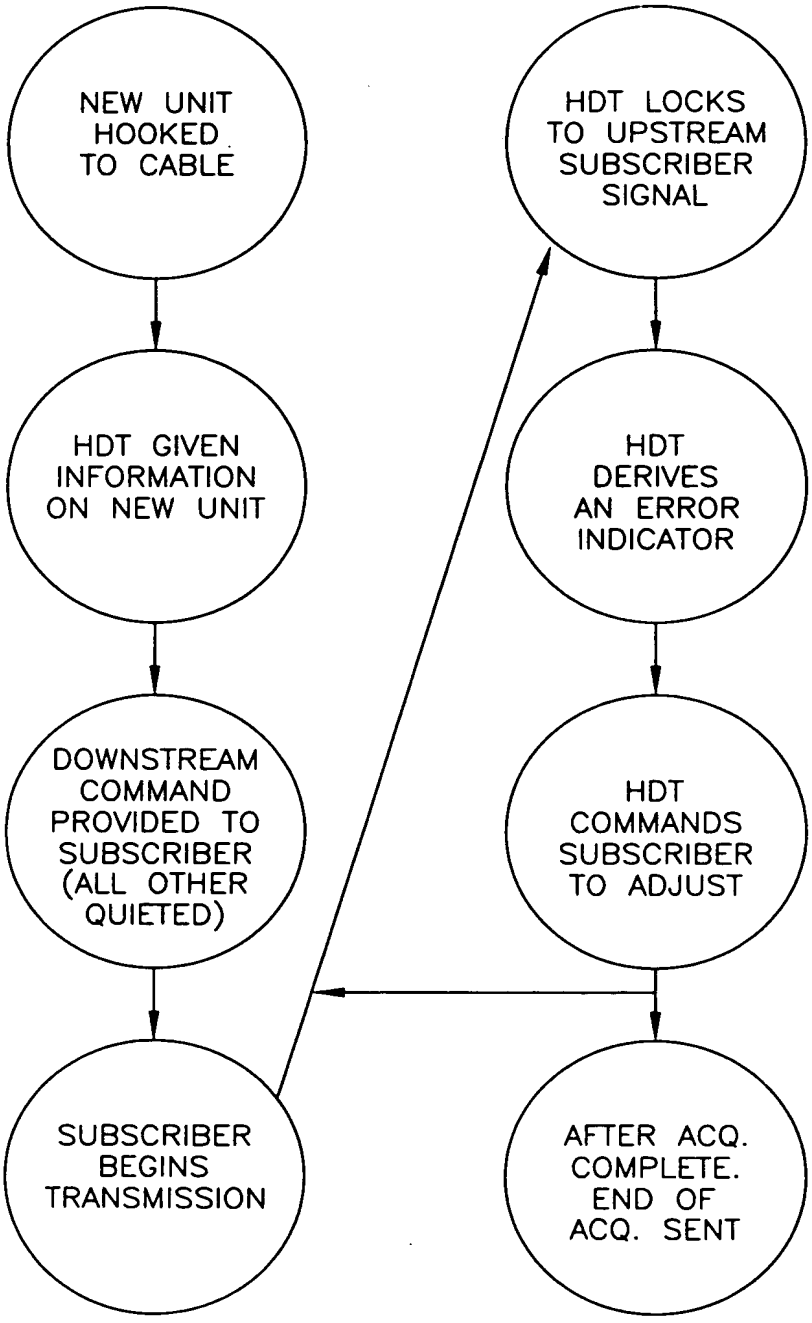

NEW UNIT HOOKED TO CABLE
HDT GIVEN INFORMATION ON NEW UNIT
DOWNSTREAM COMMAND PROVIDED TO SUBSCRIBER (ALL OTHER QUIETED)
SUBSCRIBER BEGINS TRANSMISSION
HDT LOCKS TO UPSTREAM SUBSCRIBER SIGNAL
HDT DERIVES AN ERROR INDICATOR
HDT COMMANDS SUBSCRIBER TO ADJUST
AFTER ACQ. COMPLETE. END OF ACQ. SENT

FIG. 27

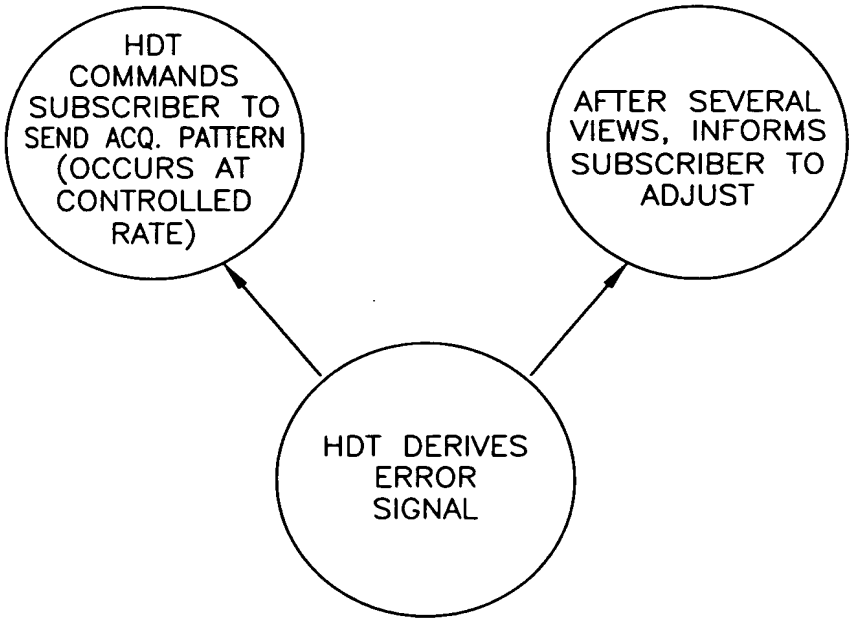

HDT COMMANDS SUBSCRIBER TO SEND ACQ. PATTERN (OCCURS AT CONTROLLED RATE)
AFTER SEVERAL VIEWS, INFORMS SUBSCRIBER TO ADJUST
HDT DERIVES ERROR SIGNAL

FIG. 28

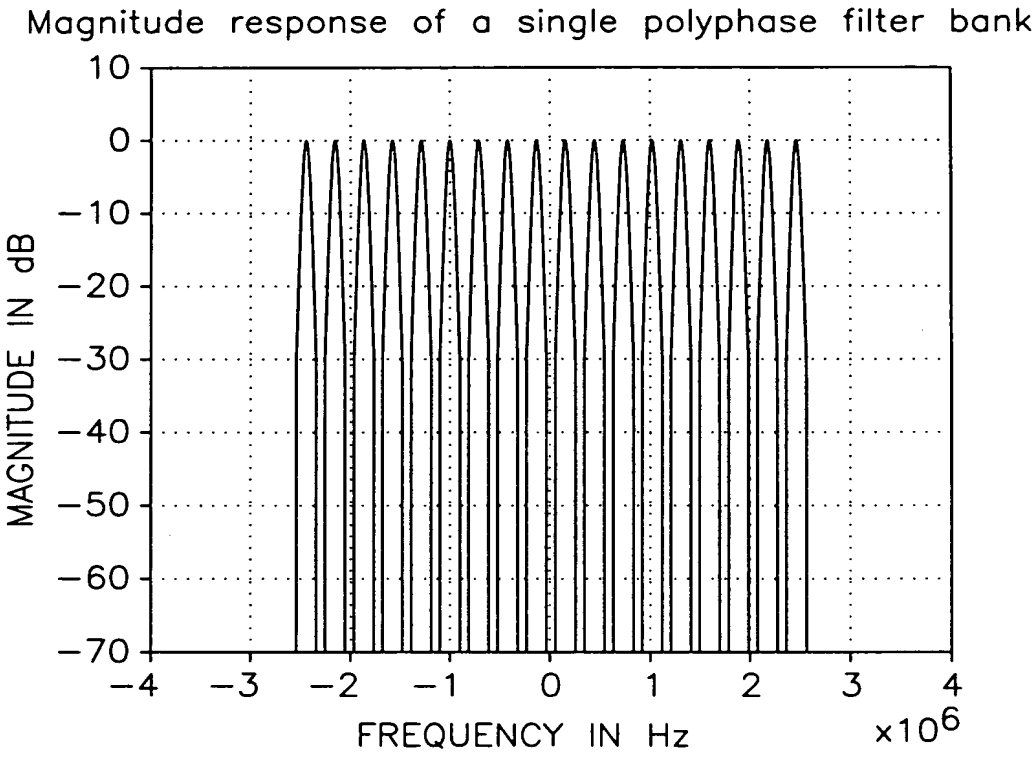

Magnitude response of a single polyphase filter bank
MAGNITUDE IN dB
10
0
−10
−20
−30
−40
−50
−60
−70
−4
−3
−2
−1
0
1
2
3
4
FREQUENCY IN Hz
x10^6

FIG. 29

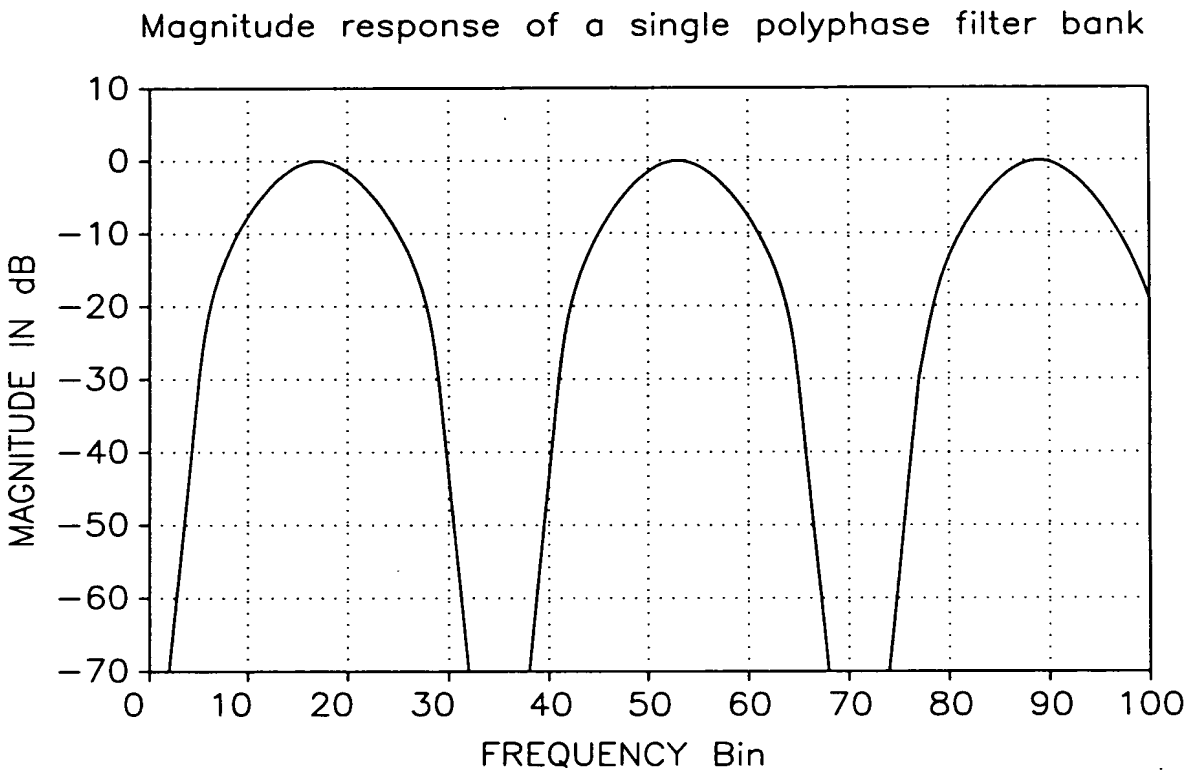

Magnitude response of a single polyphase filter bank
MAGNITUDE IN dB
10
0
−10
−20
−30
−40
−50
−60
−70
0
10
20
30
40
50
60
70
80
90
100
FREQUENCY Bin

FIG. 30

T06020 "42ET060

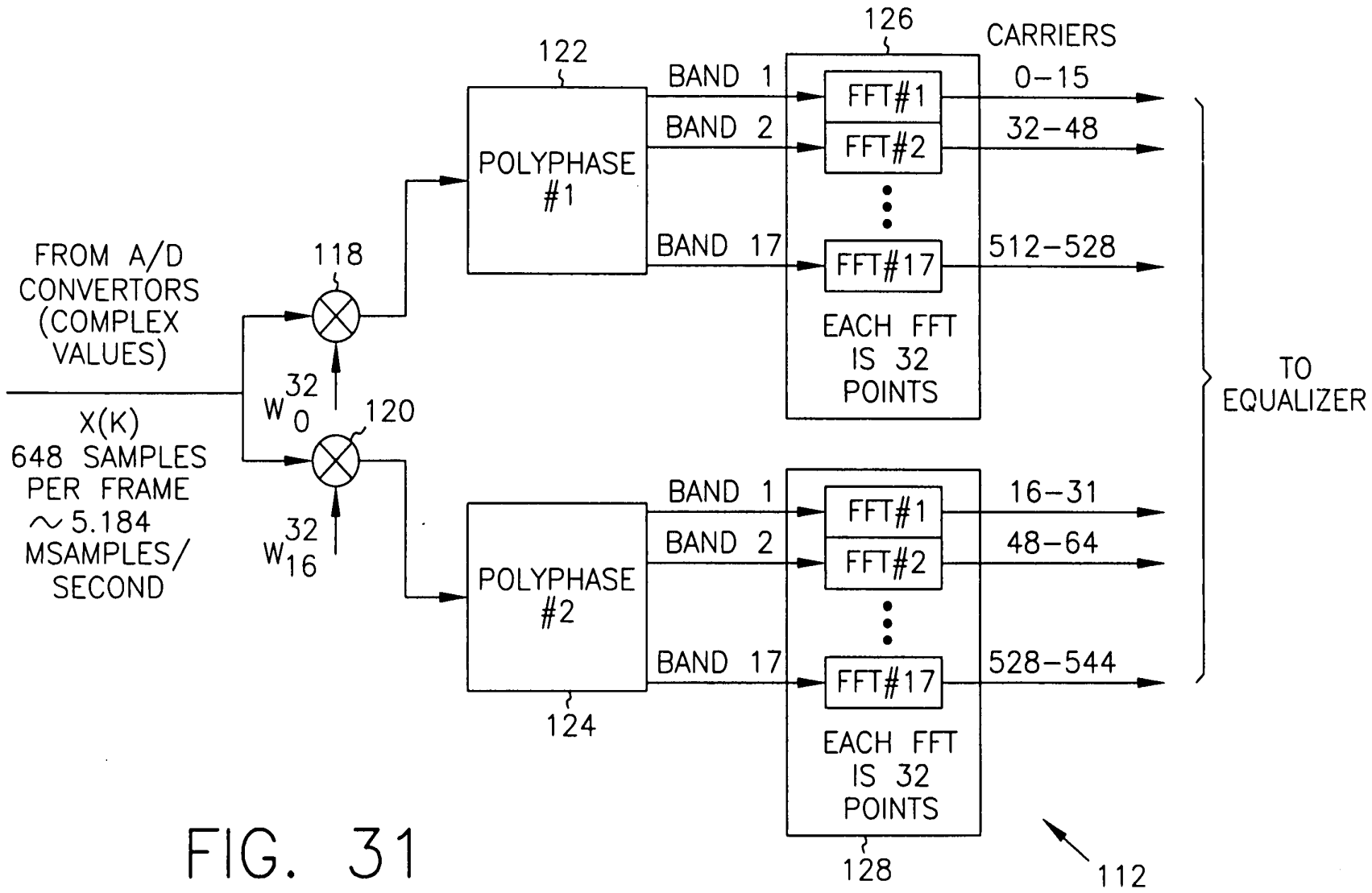


FIG. 31

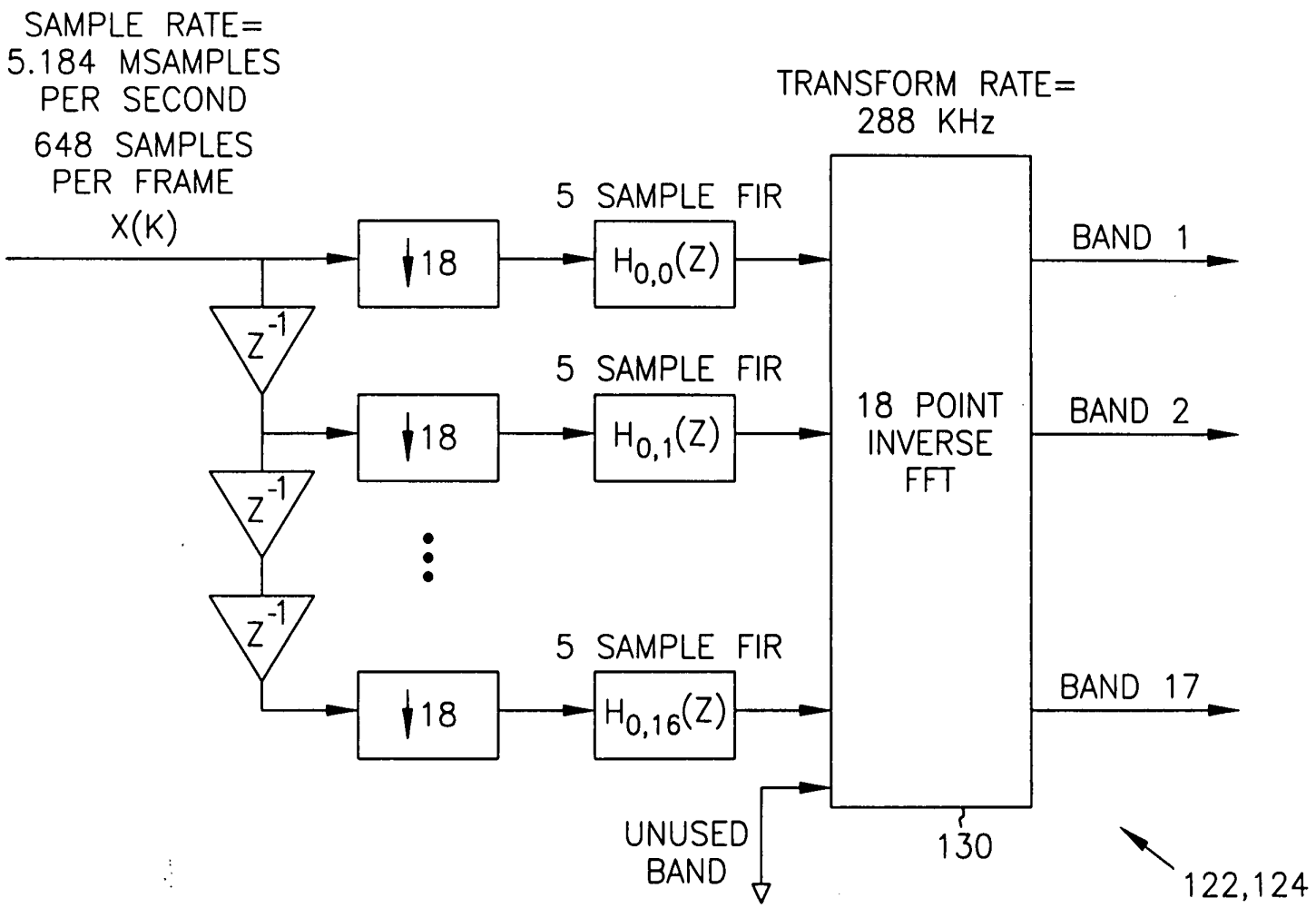
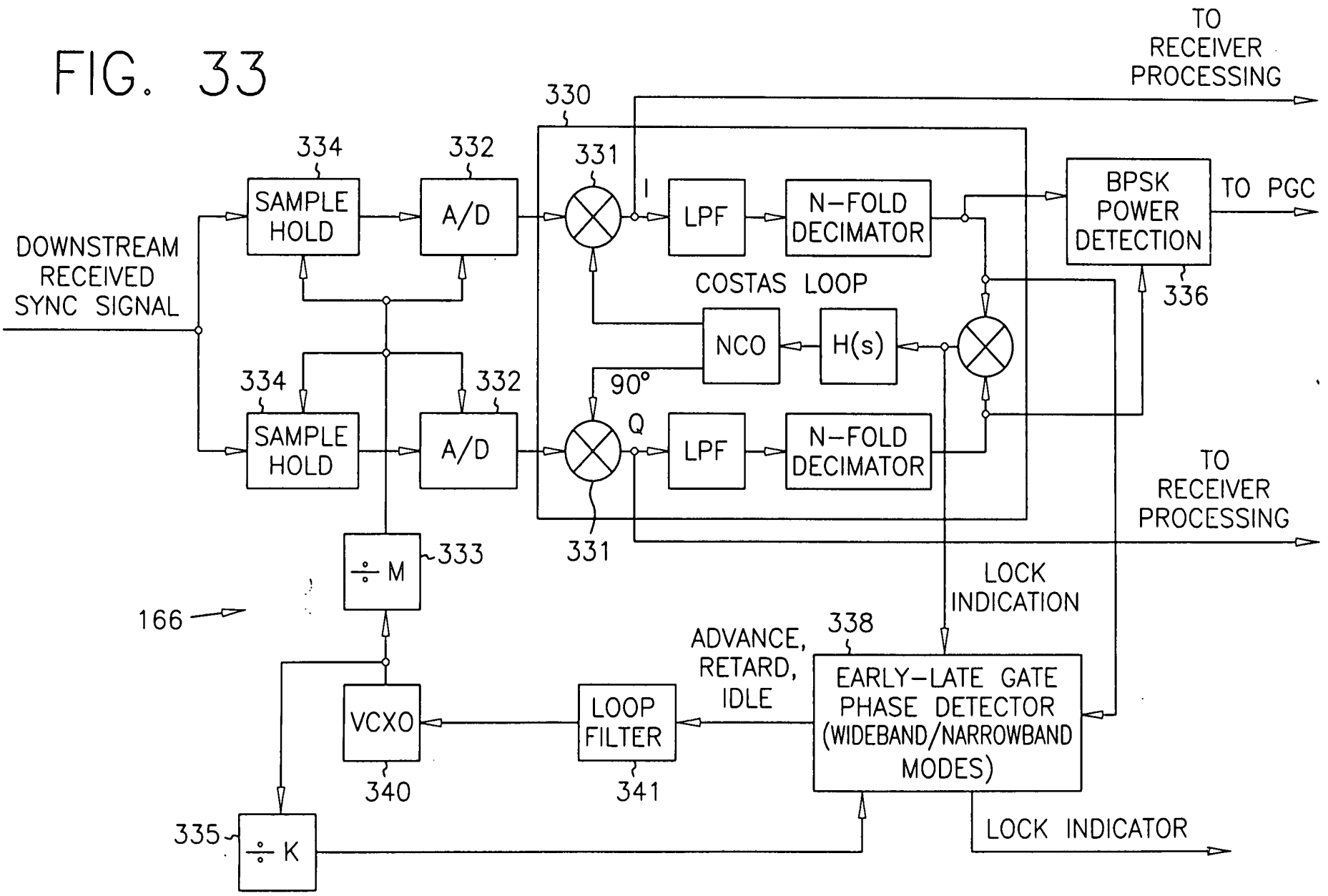

SAMPLE RATE=
5.184 MSAMPLES
PER SECOND
648 SAMPLES
PER FRAME
X(K)
TRANSFORM RATE=
288 KHz
5 SAMPLE FIR
5 SAMPLE FIR
5 SAMPLE FIR
18
18
18
$H_{0,0}(Z)$
$H_{0,1}(Z)$
$H_{0,16}(Z)$
Z^{-1}
Z^{-1}
Z^{-1}
18 POINT
INVERSE
FFT
BAND 1
BAND 2
BAND 17
UNUSED
BAND
130
122,124

FIG. 32

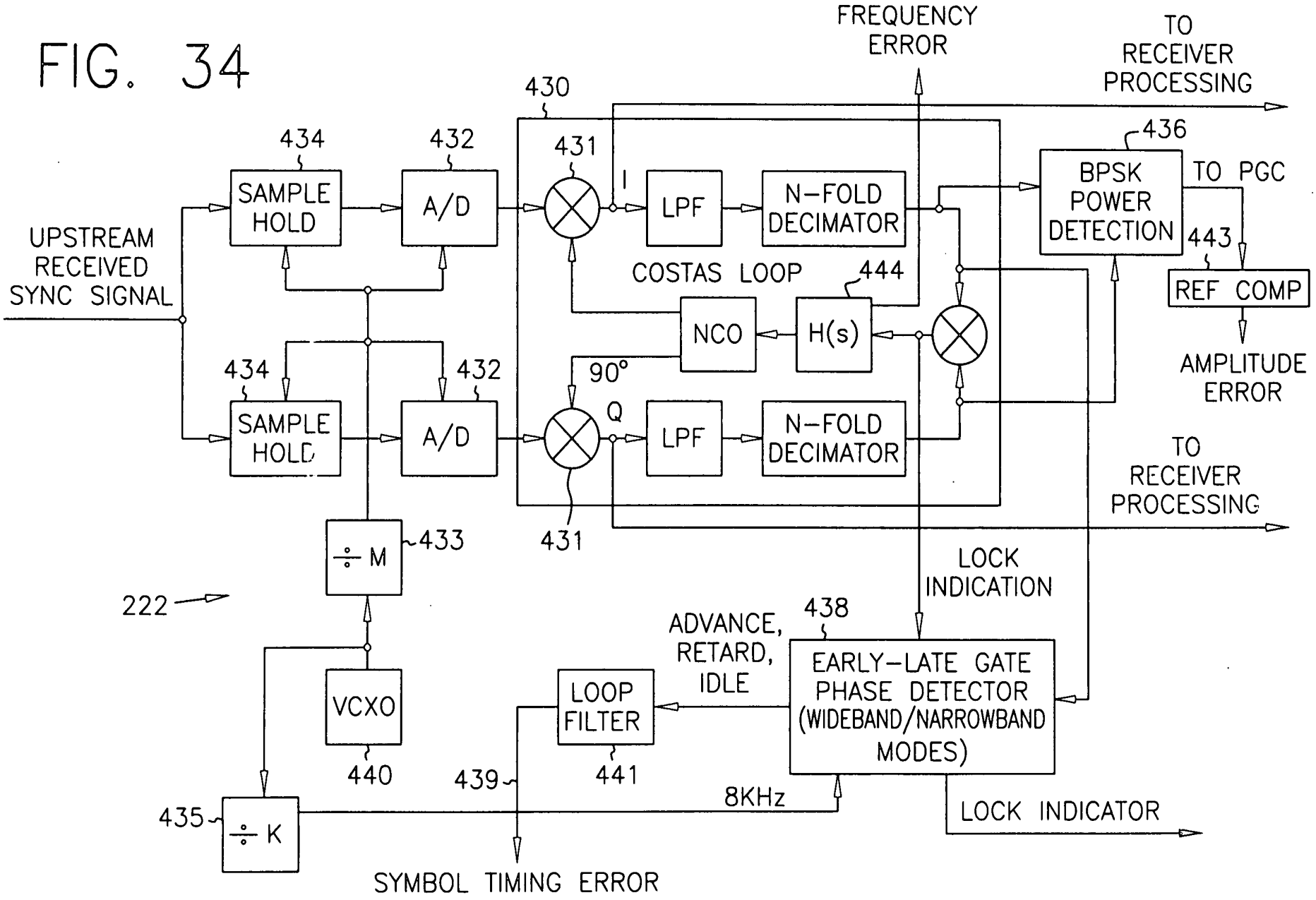
TD6620 "ZETD660

FIG. 33



T66020 "42T0660

FIG. 34



T06020 "h2ET0660

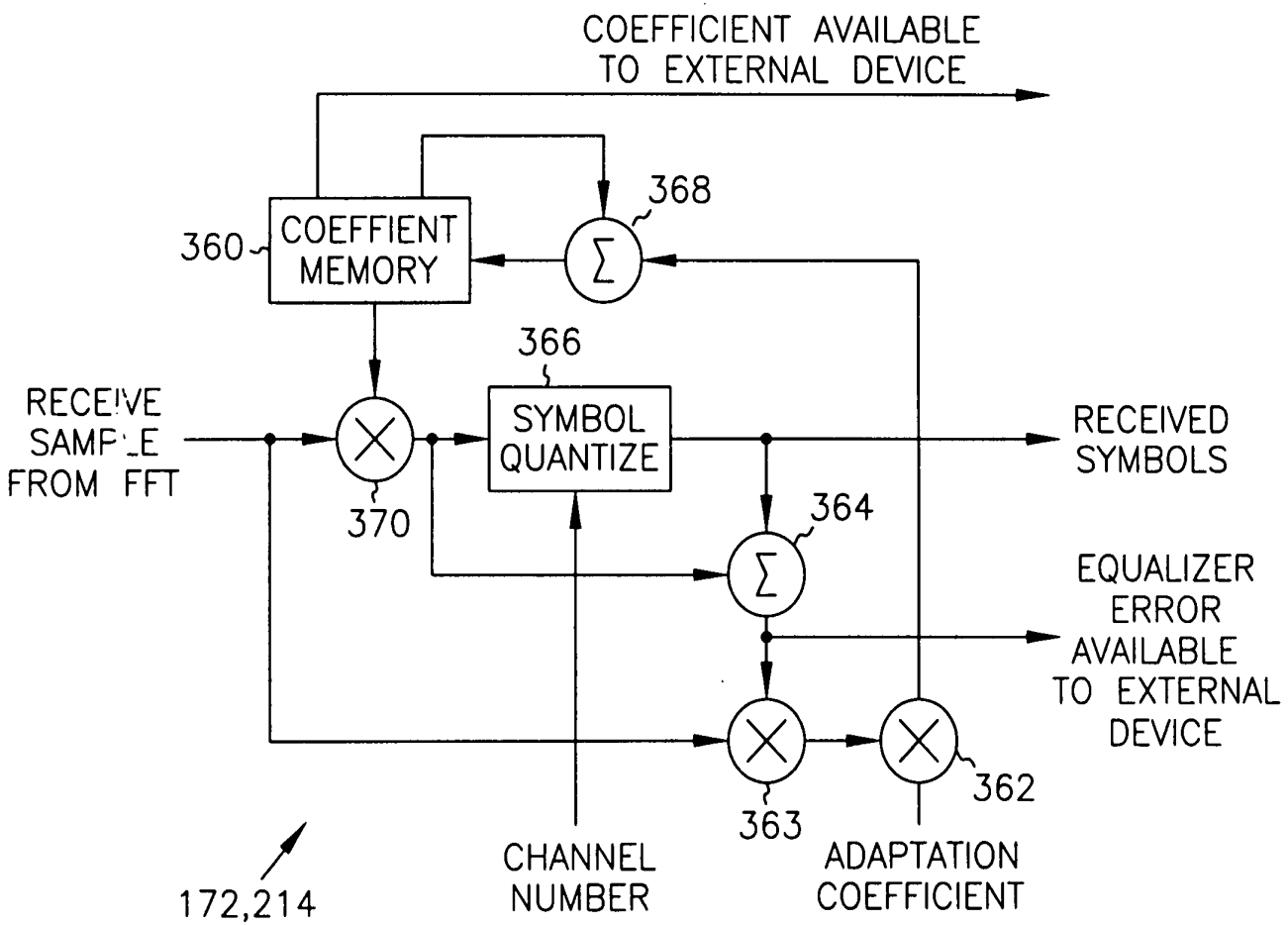


FIG. 35

T06020"h2ET0660

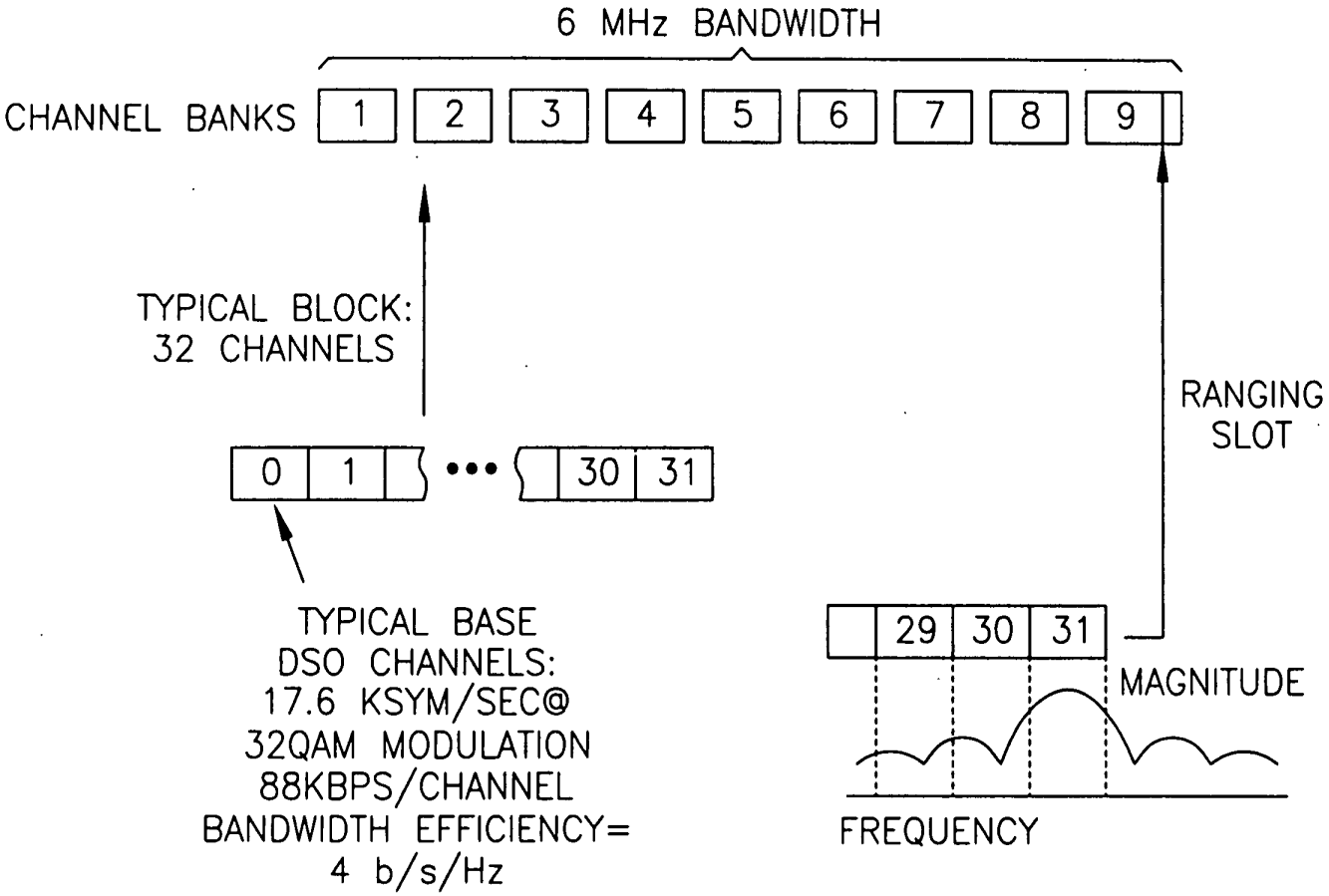


FIG. 36

T06020"42T0660

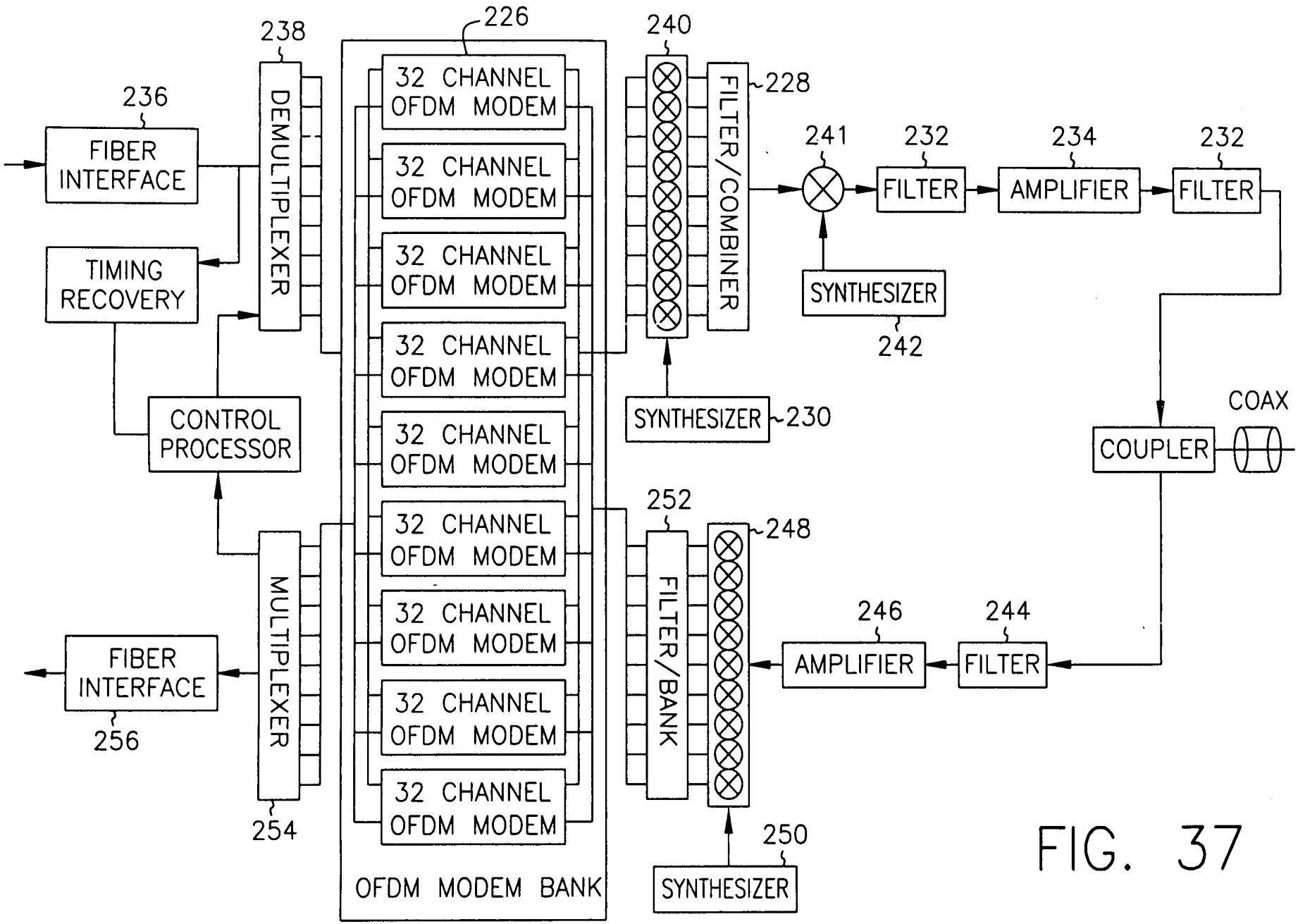


FIG. 37

T06020"h2ET060

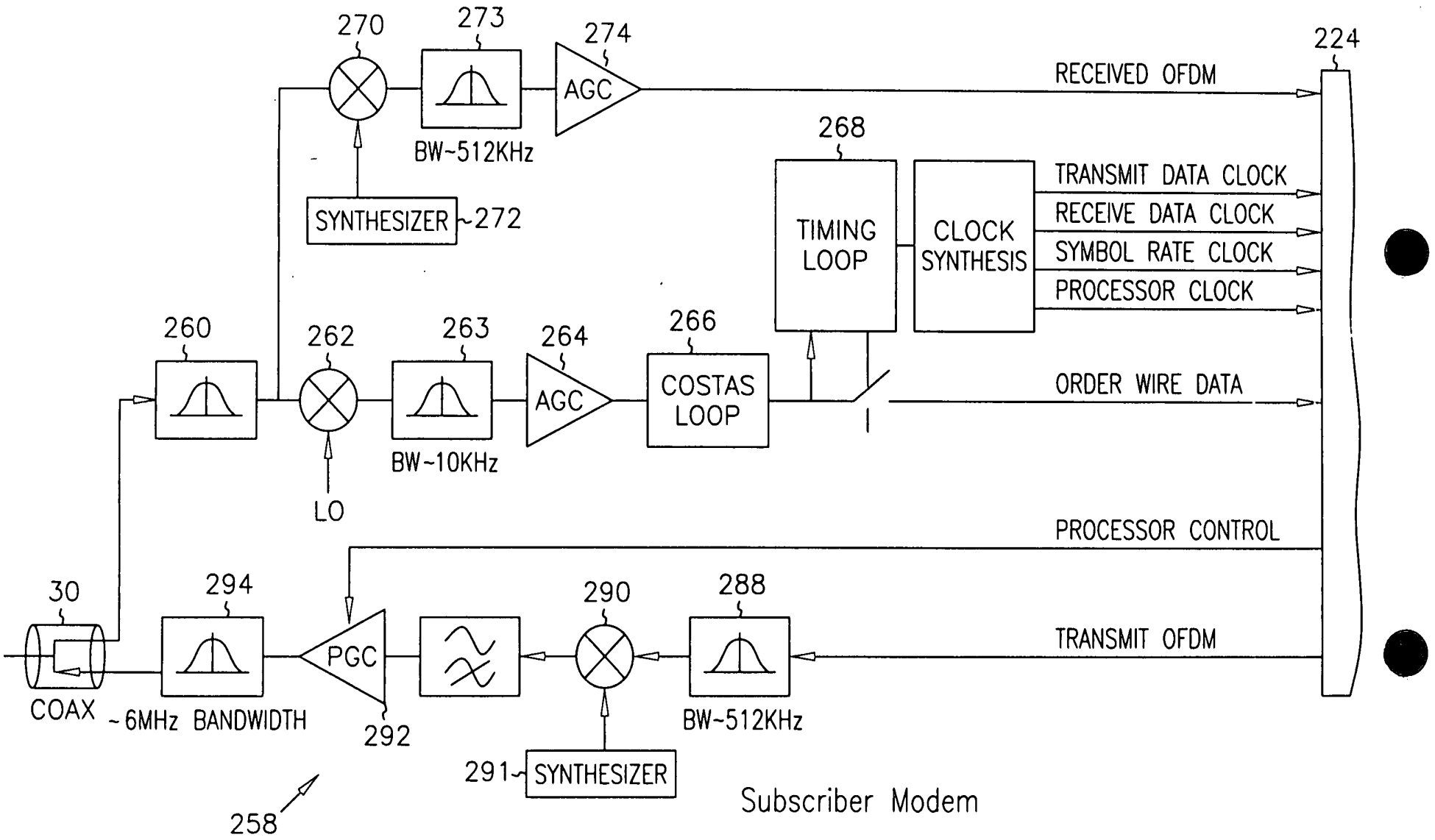


FIG. 38

T06020"h2ET0660

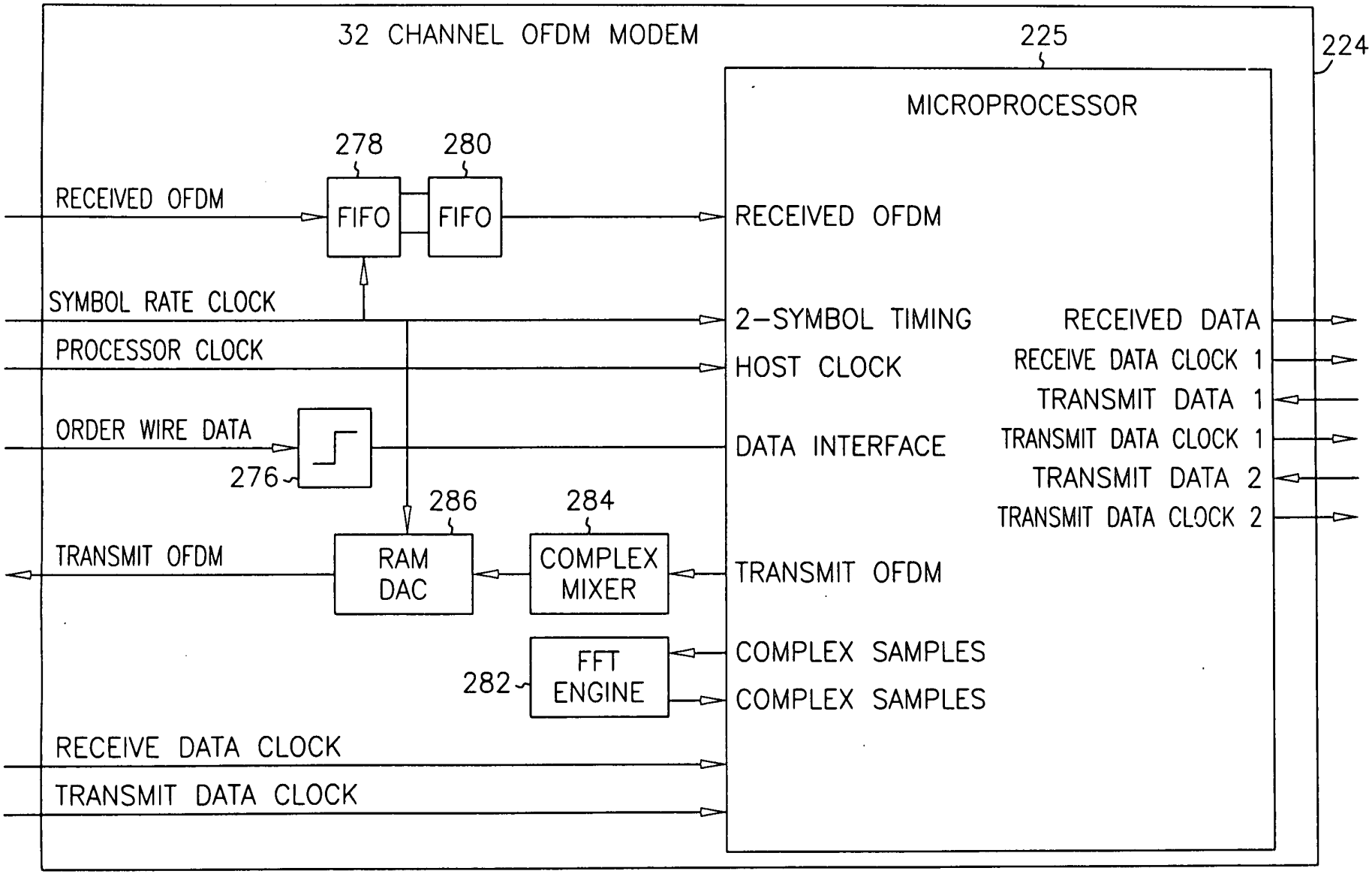


FIG. 39

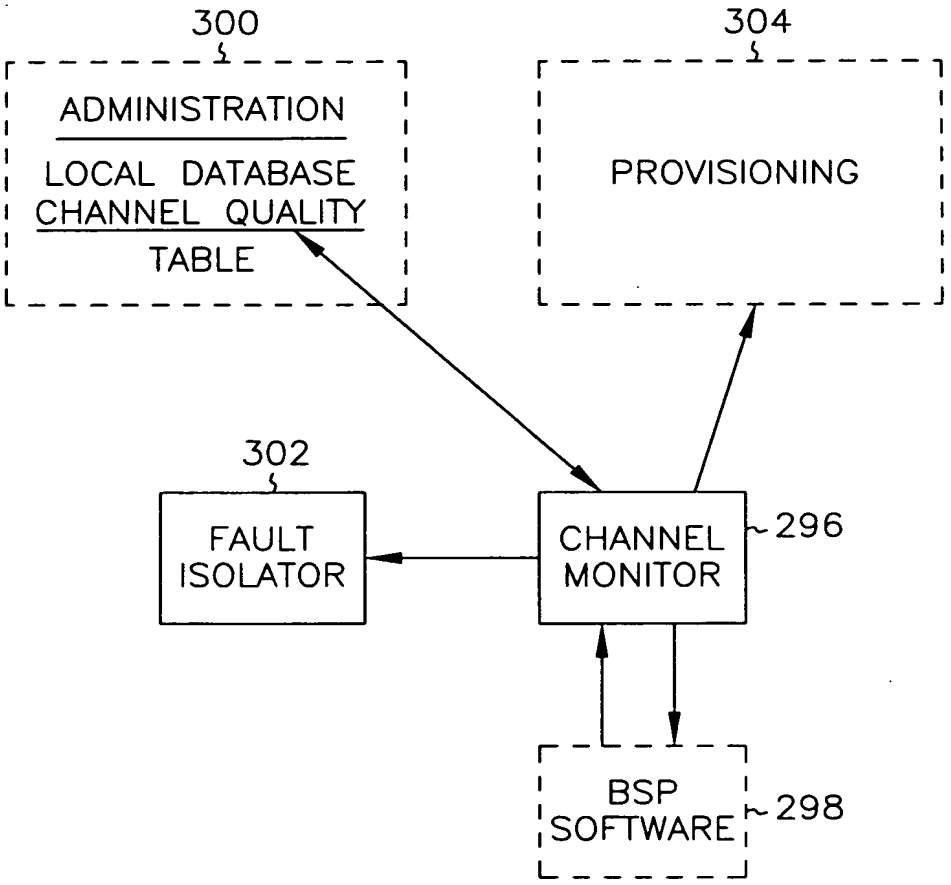

300
304
ADMINISTRATION
LOCAL DATABASE
CHANNEL QUALITY
TABLE
PROVISIONING
302
FAULT
ISOLATOR
CHANNEL
MONITOR
296
BSP
SOFTWARE
298

FIG. 40

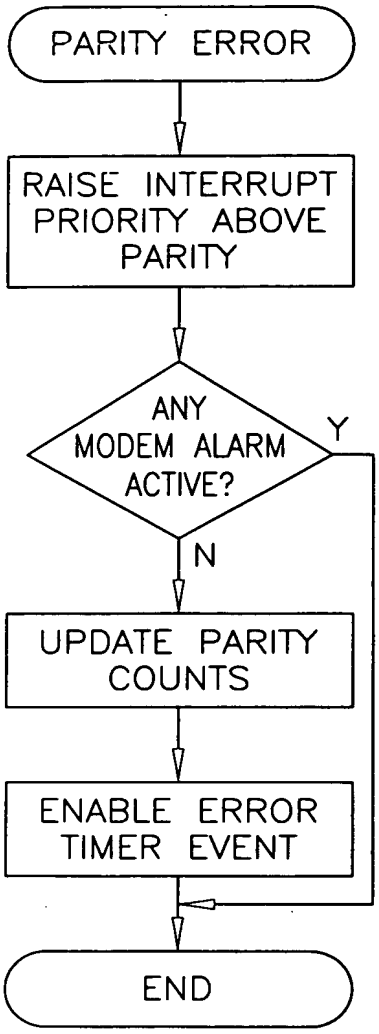


FIG. 41

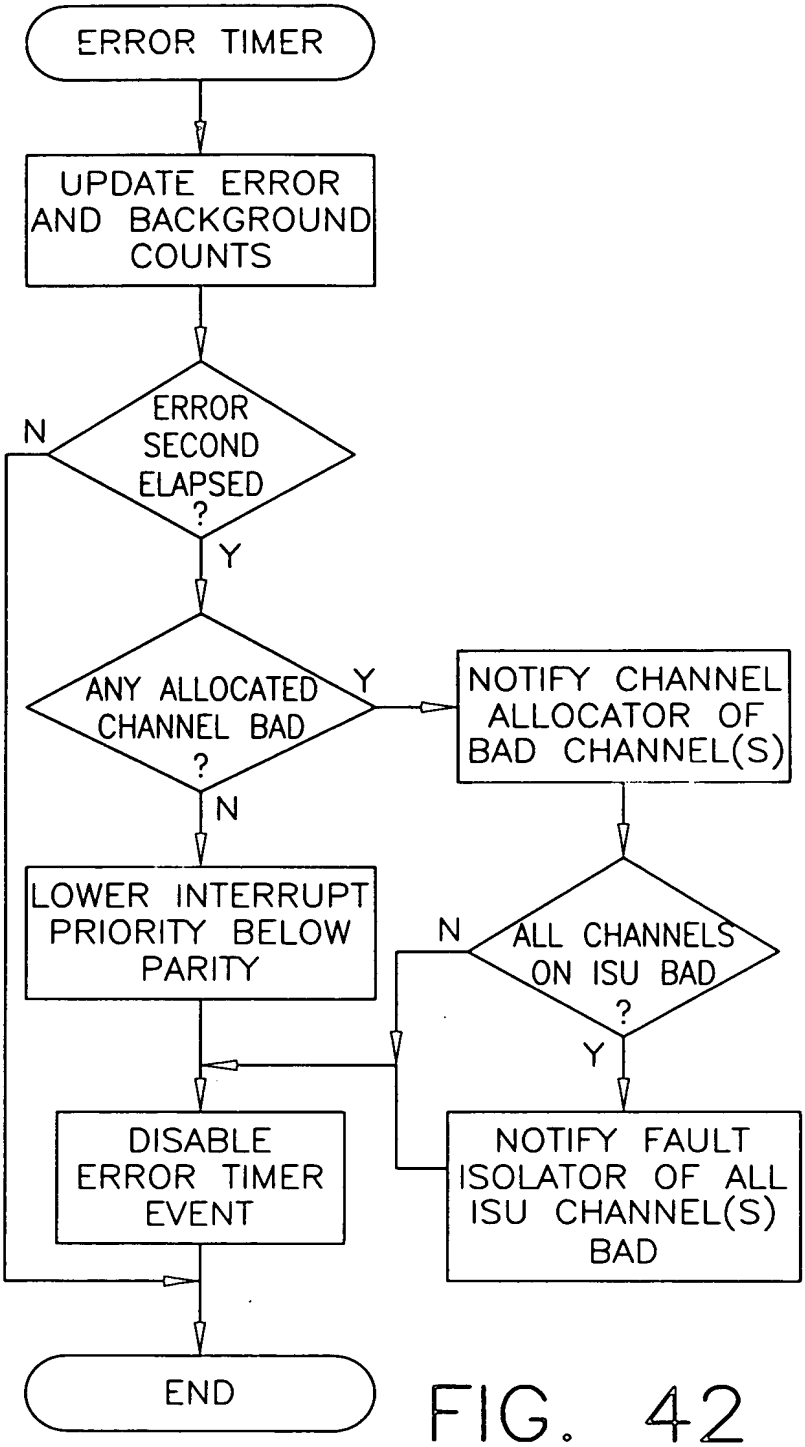


FIG. 42

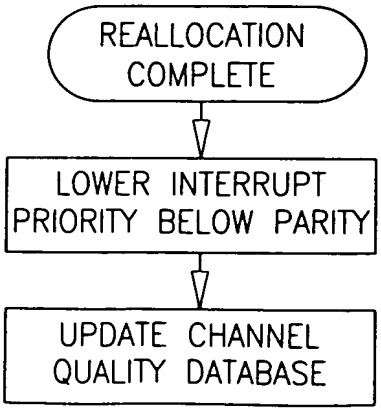
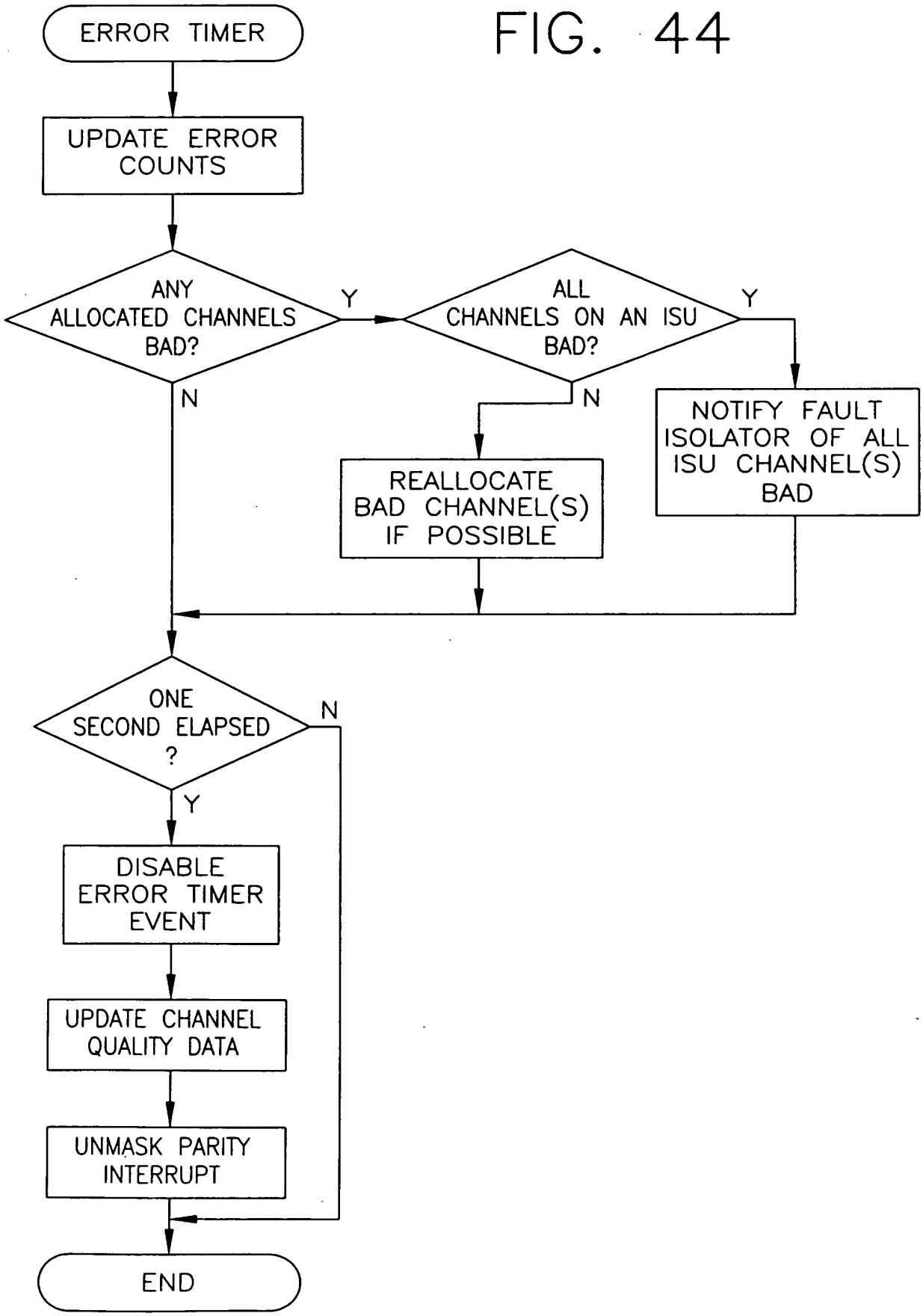


FIG. 43

FIG. 44


ERROR TIMER
UPDATE ERROR COUNTS
ANY ALLOCATED CHANNELS BAD?
Y
ALL CHANNELS ON AN ISU BAD?
Y
N
N
NOTIFY FAULT ISOLATOR OF ALL ISU CHANNEL(S) BAD
REALLOCATE BAD CHANNEL(S) IF POSSIBLE
ONE SECOND ELAPSED ?
N
Y
DISABLE ERROR TIMER EVENT
UPDATE CHANNEL QUALITY DATA
UNMASK PARITY INTERRUPT
END

FOR OFFICIAL USE ONLY

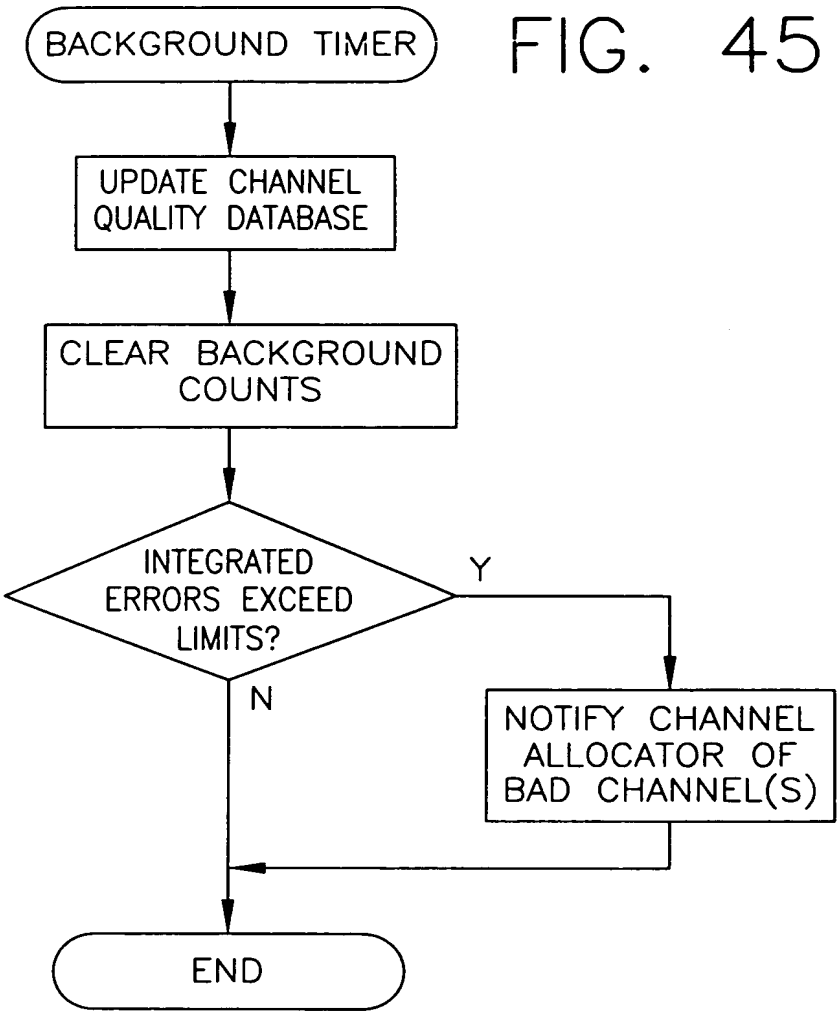


FIG. 45

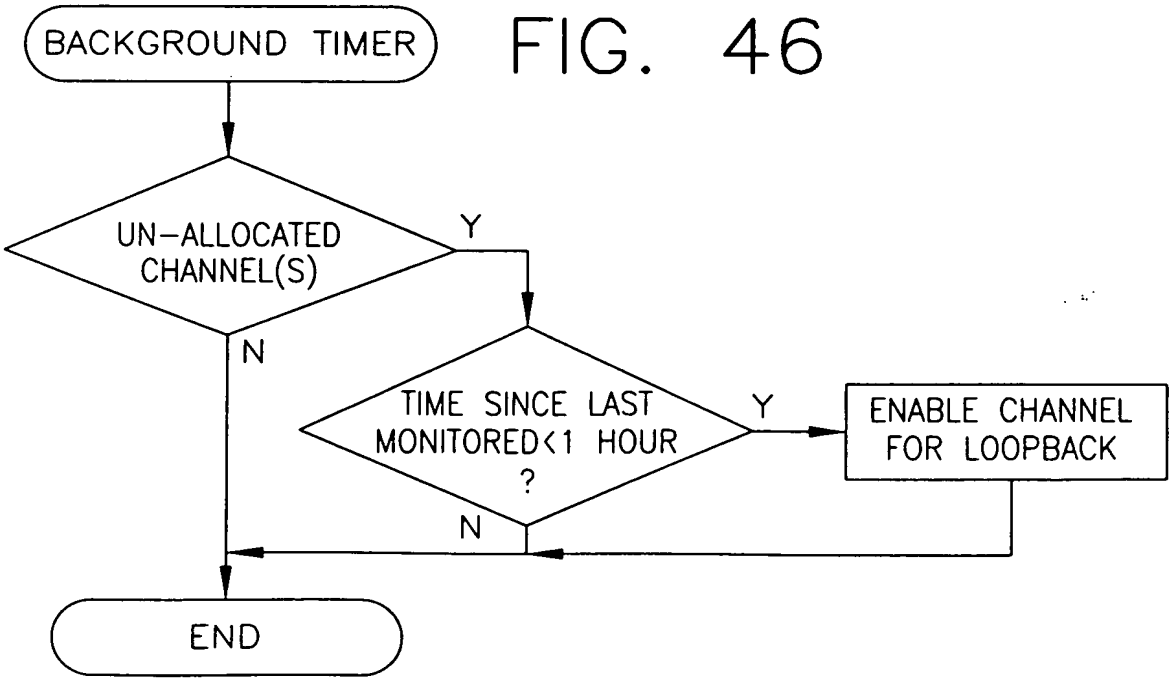


FIG. 46

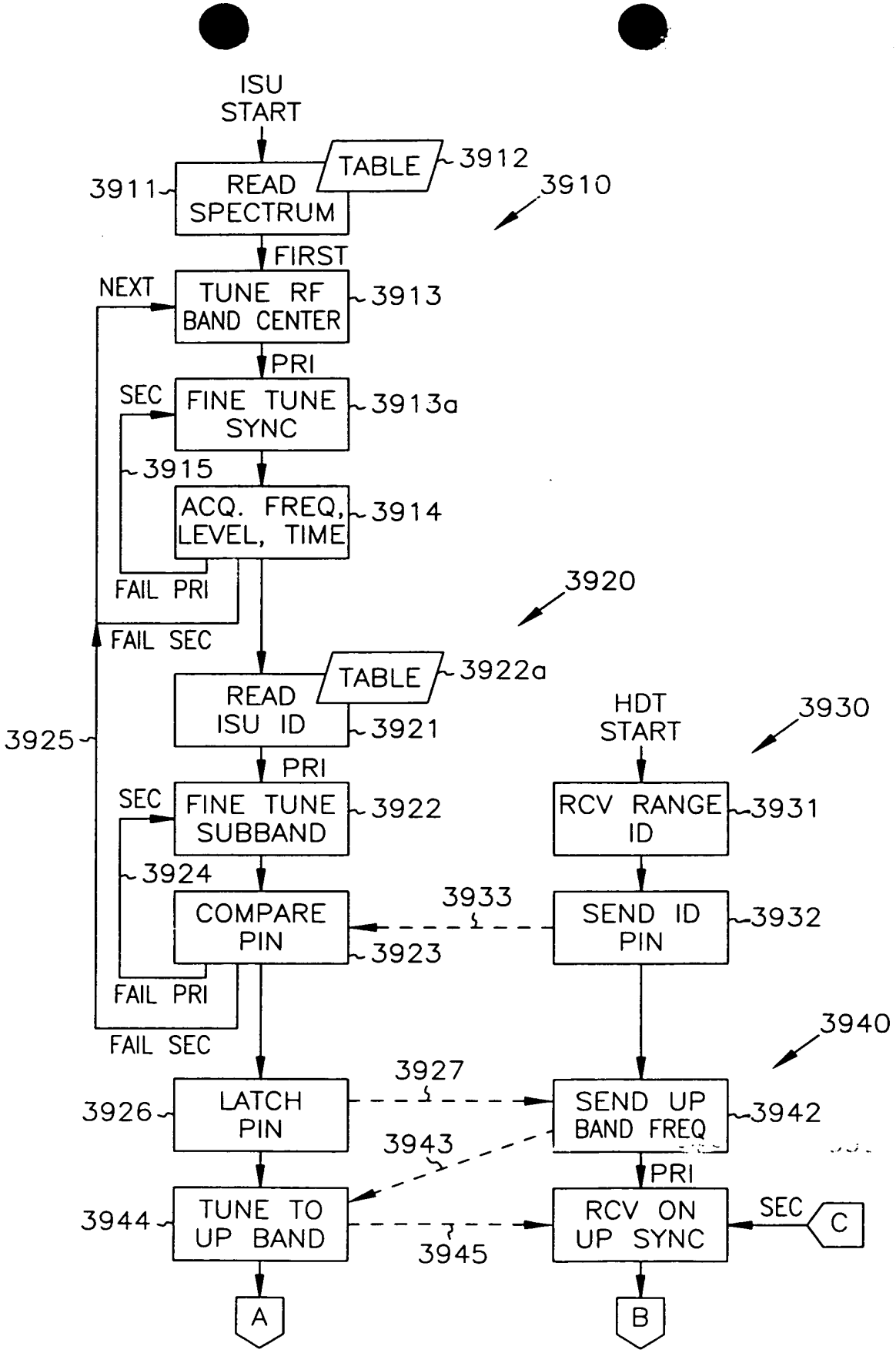

ISU START
TABLE
3912
3911
READ SPECTRUM
3910
FIRST
NEXT
TUNE RF BAND CENTER
3913
PRI
SEC
FINE TUNE SYNC
3913a
3915
ACQ. FREQ, LEVEL, TIME
3914
FAIL PRI
FAIL SEC
3920
TABLE
3922a
READ ISU ID
3921
3925
PRI
SEC
FINE TUNE SUBBAND
3922
3924
COMPARE PIN
3923
FAIL PRI
FAIL SEC
HDT START
3930
RCV RANGE ID
3931
3933
SEND ID PIN
3932
3940
3927
3926
LATCH PIN
SEND UP BAND FREQ
3942
3943
PRI
3944
TUNE TO UP BAND
3945
RCV ON UP SYNC
SEC
C
A
B

FIG. 47

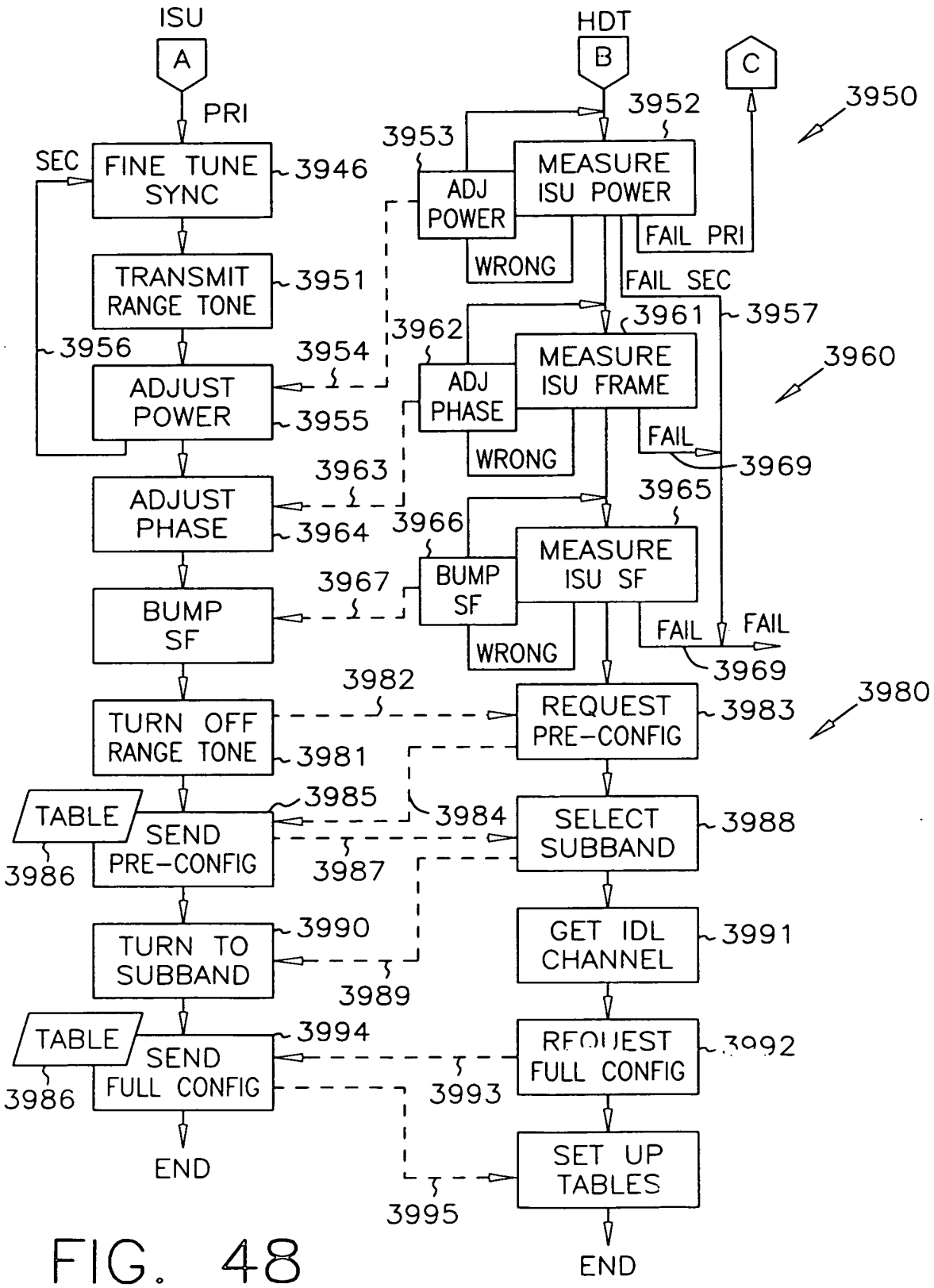

ISU
A
PRI
SEC
FINE TUNE SYNC
3946
TRANSMIT RANGE TONE
3951
3956
ADJUST POWER
3954
3955
ADJUST PHASE
3963
3964
BUMP SF
3967
TURN OFF RANGE TONE
3981
TABLE
SEND PRE-CONFIG
3985
3986
3987
TURN TO SUBBAND
3990
3989
TABLE
SEND FULL CONFIG
3994
3986
3993
END
HDT
B
C
3952
3950
3953
ADJ POWER
MEASURE ISU POWER
WRONG
FAIL PRI
FAIL SEC
3961
3957
3962
ADJ PHASE
MEASURE ISU FRAME
3960
WRONG
FAIL
3969
3965
3966
BUMP SF
MEASURE ISU SF
WRONG
FAIL
FAIL
3969
3982
REQUEST PRE-CONFIG
3983
3980
3984
SELECT SUBBAND
3988
GET IDL CHANNEL
3991
REQUEST FULL CONFIG
3992
3995
SET UP TABLES
END

FIG. 48

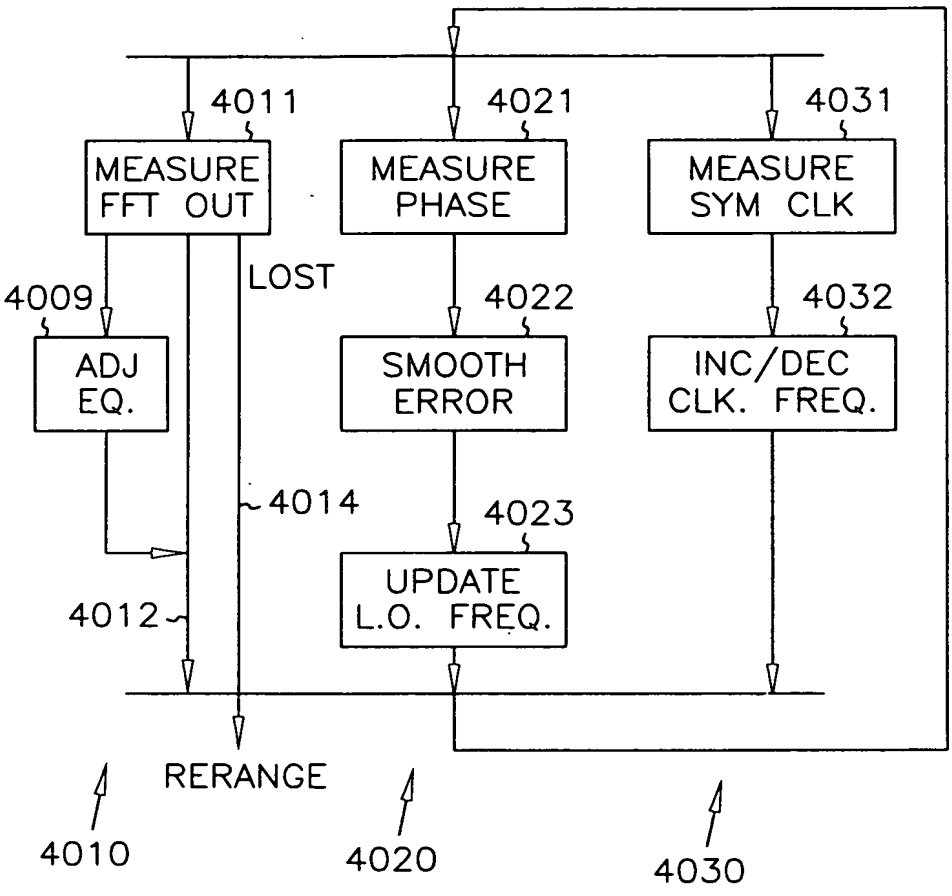

4011
4021
4031
MEASURE FFT OUT
MEASURE PHASE
MEASURE SYM CLK
LOST
4009
4022
4032
ADJ EQ.
SMOOTH ERROR
INC/DEC CLK. FREQ.
4014
4023
UPDATE L.O. FREQ.
4012
RERANGE
4010
4020
4030

FIG. 49

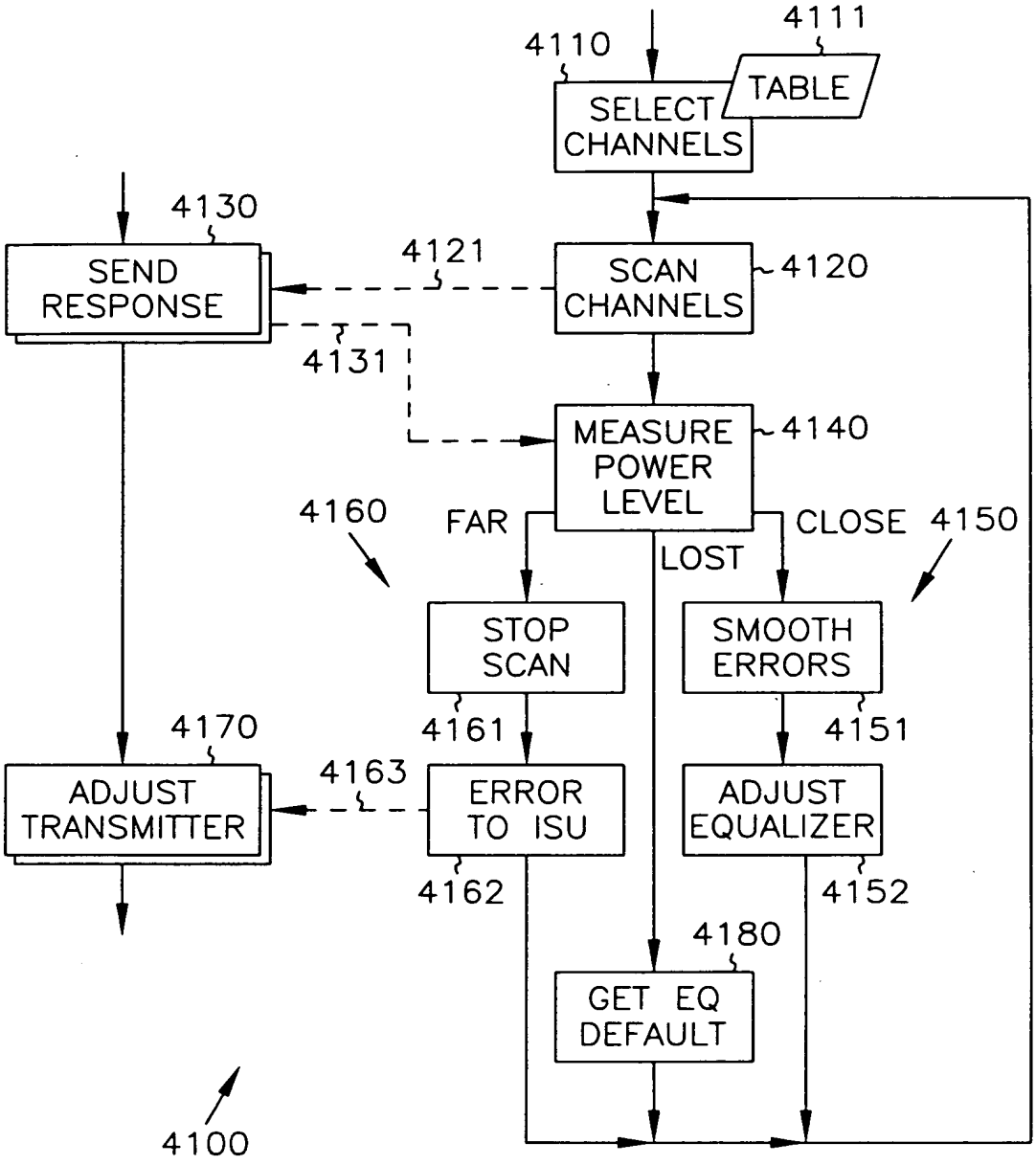

4110
4111
SELECT CHANNELS
TABLE
4130
SEND RESPONSE
4121
SCAN CHANNELS
4120
4131
MEASURE POWER LEVEL
4140
4160
FAR
CLOSE
4150
LOST
STOP SCAN
SMOOTH ERRORS
4161
4151
4170
4163
ADJUST TRANSMITTER
ERROR TO ISU
ADJUST EQUALIZER
4162
4152
4180
GET EQ DEFAULT
4100

FIG. 50

T0602D "h2ET0660

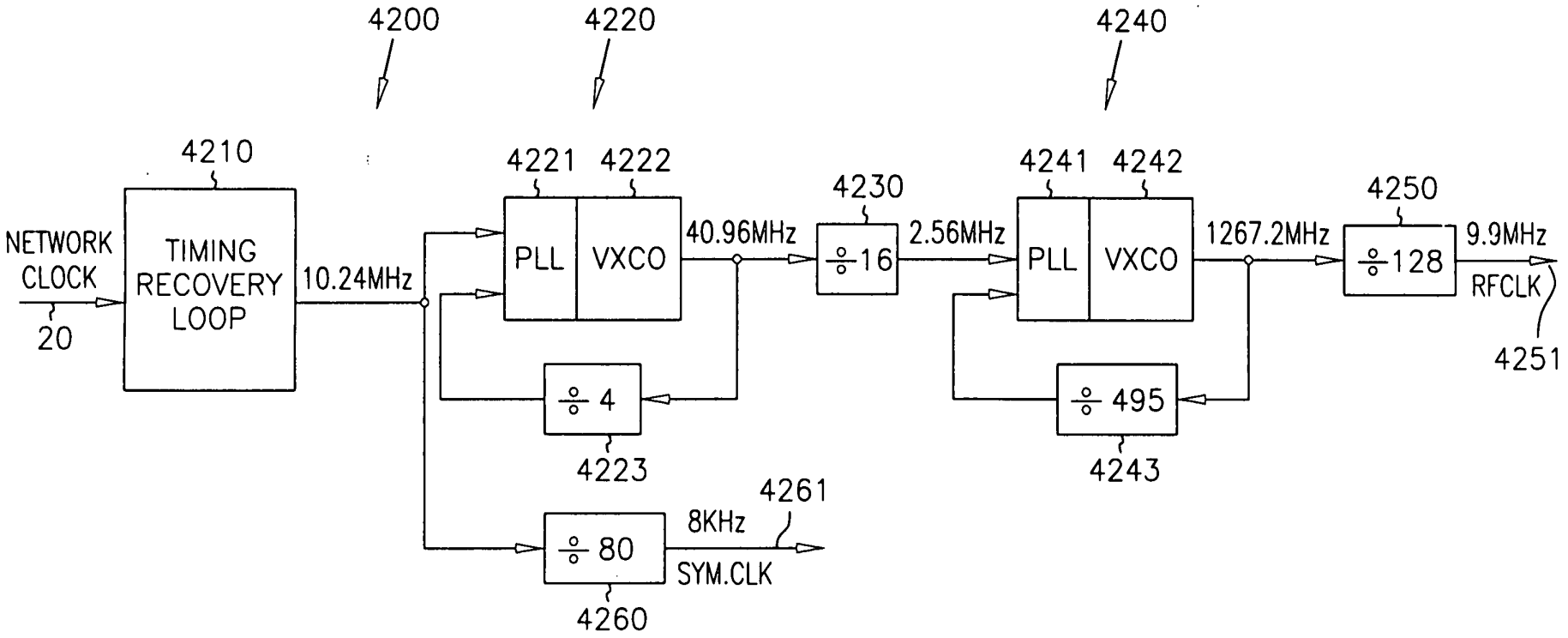


FIG. 51

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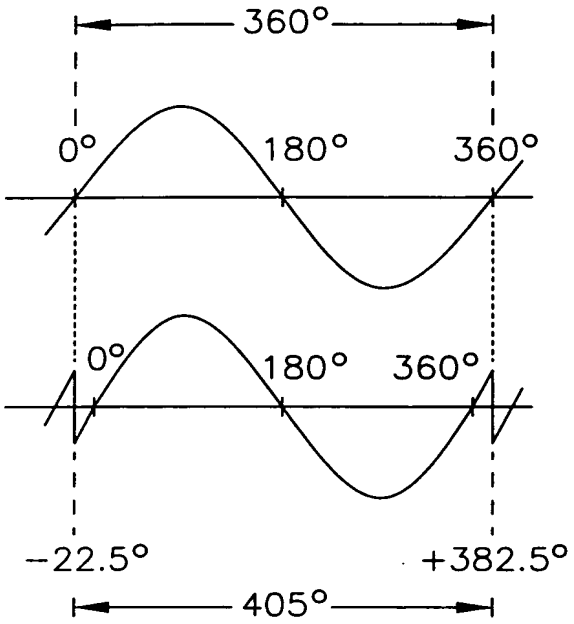


FIG. 52

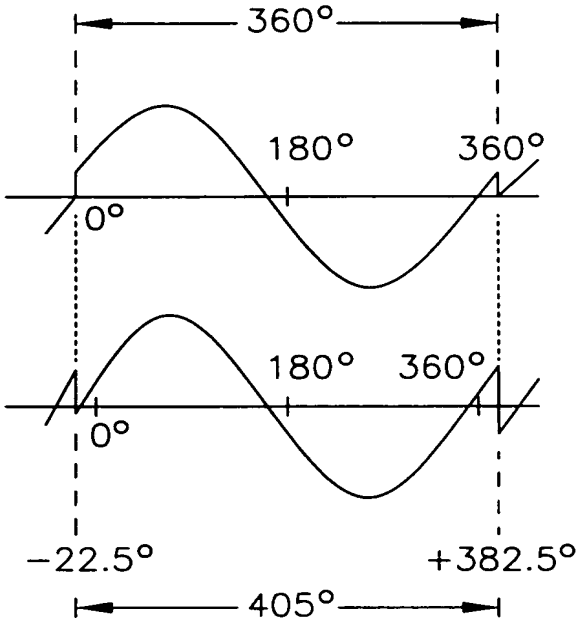


FIG. 53

T06020"h2ET0660

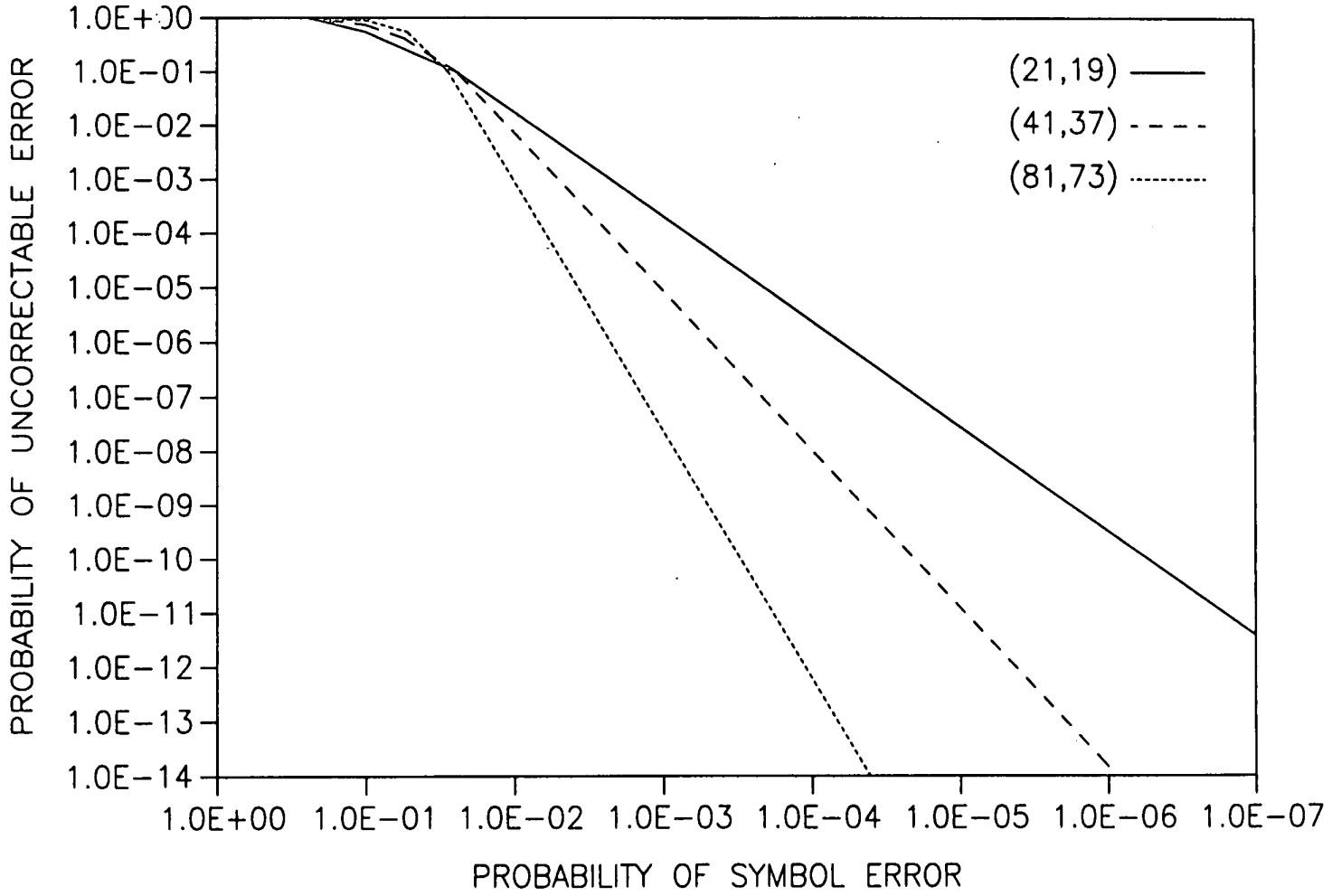


FIG. 54

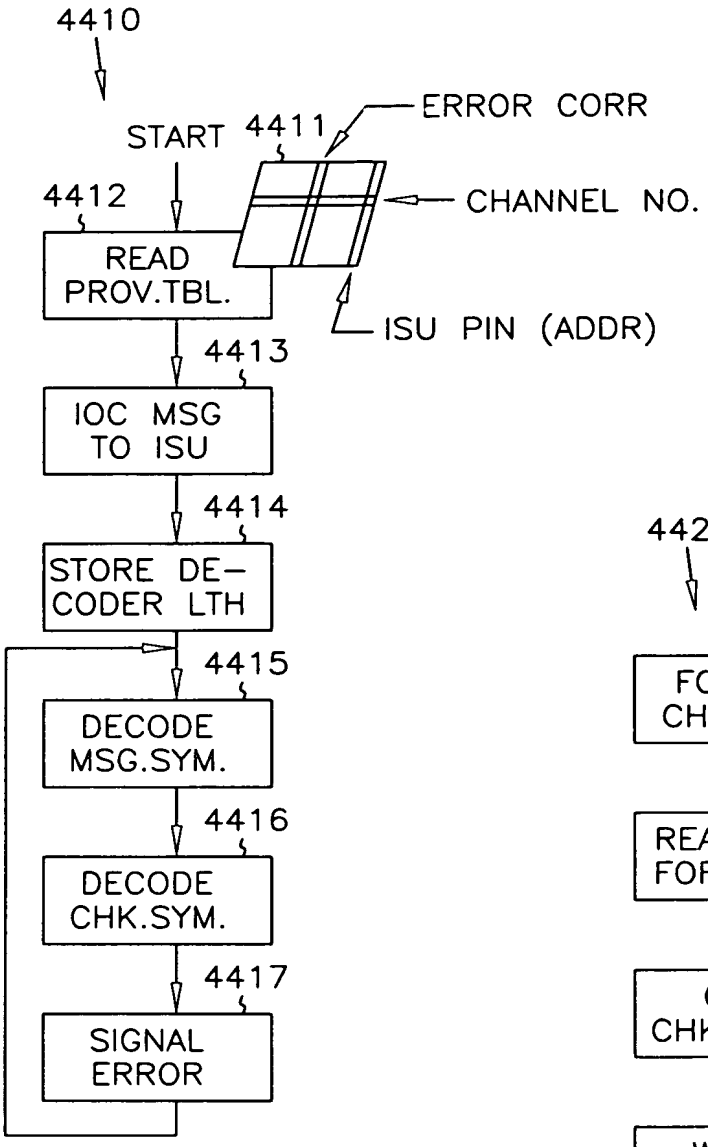

4410
START
4411
ERROR CORR
4412
CHANNEL NO.
READ PROV.TBL.
ISU PIN (ADDR)
4413
IOC MSG TO ISU
4414
STORE DE-CODER LTH
4415
DECODE MSG.SYM.
4416
DECODE CHK.SYM.
4417
SIGNAL ERROR

FIG. 55

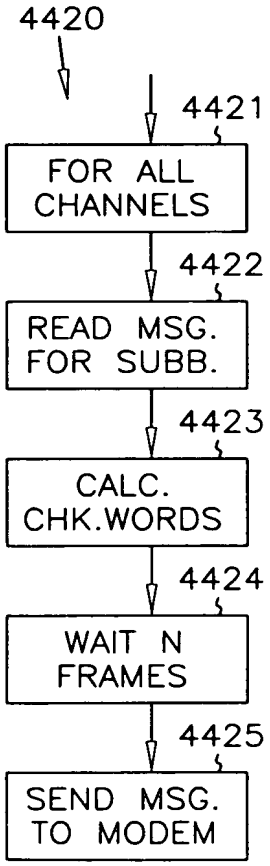

4420
4421
FOR ALL CHANNELS
4422
READ MSG. FOR SUBB.
4423
CALC. CHK.WORDS
4424
WAIT N FRAMES
4425
SEND MSG. TO MODEM

FIG. 56

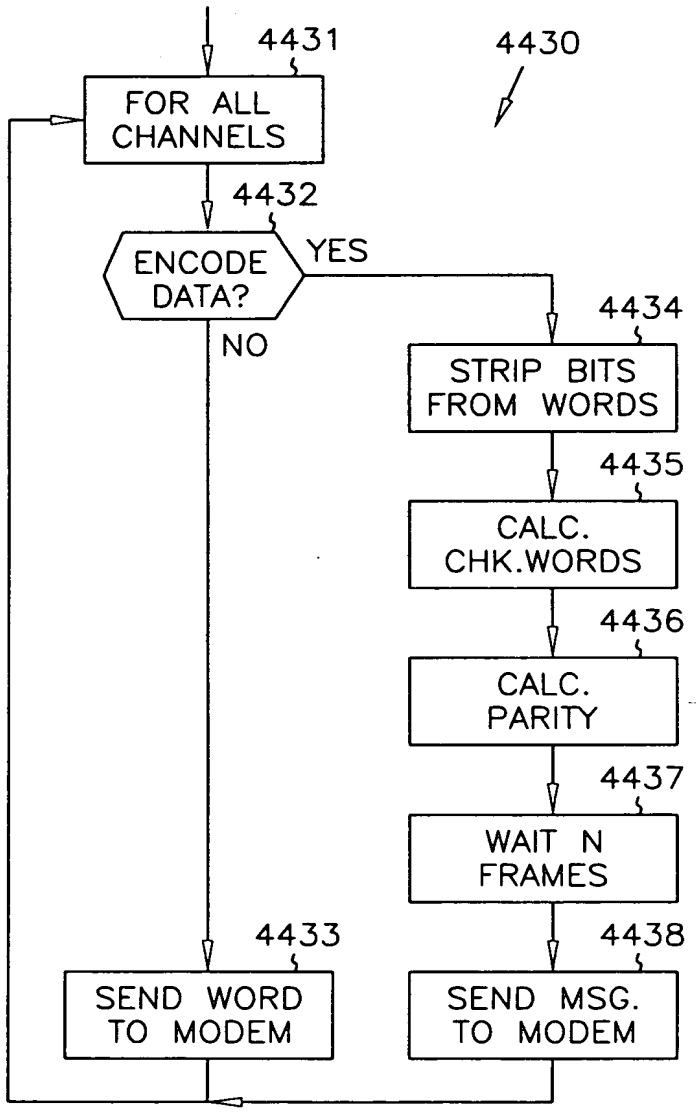

4431
4430
FOR ALL CHANNELS
4432
ENCODE DATA?
YES
NO
4434
STRIP BITS FROM WORDS
4435
CALC. CHK.WORDS
4436
CALC. PARITY
4437
WAIT N FRAMES
4433
4438
SEND WORD TO MODEM
SEND MSG. TO MODEM

FIG. 57

TO6020"4270660

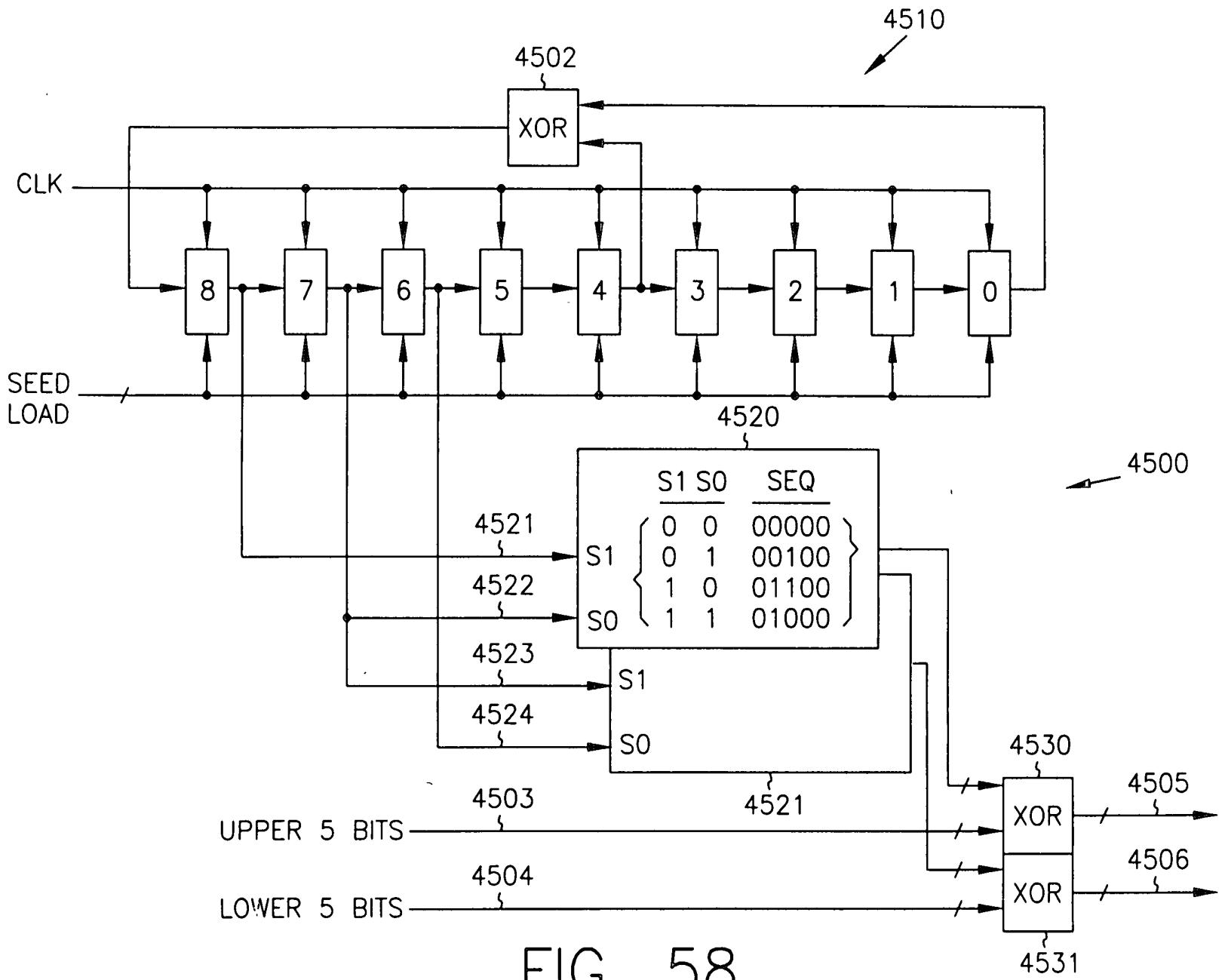


FIG. 58

Docket No. 2000.0020

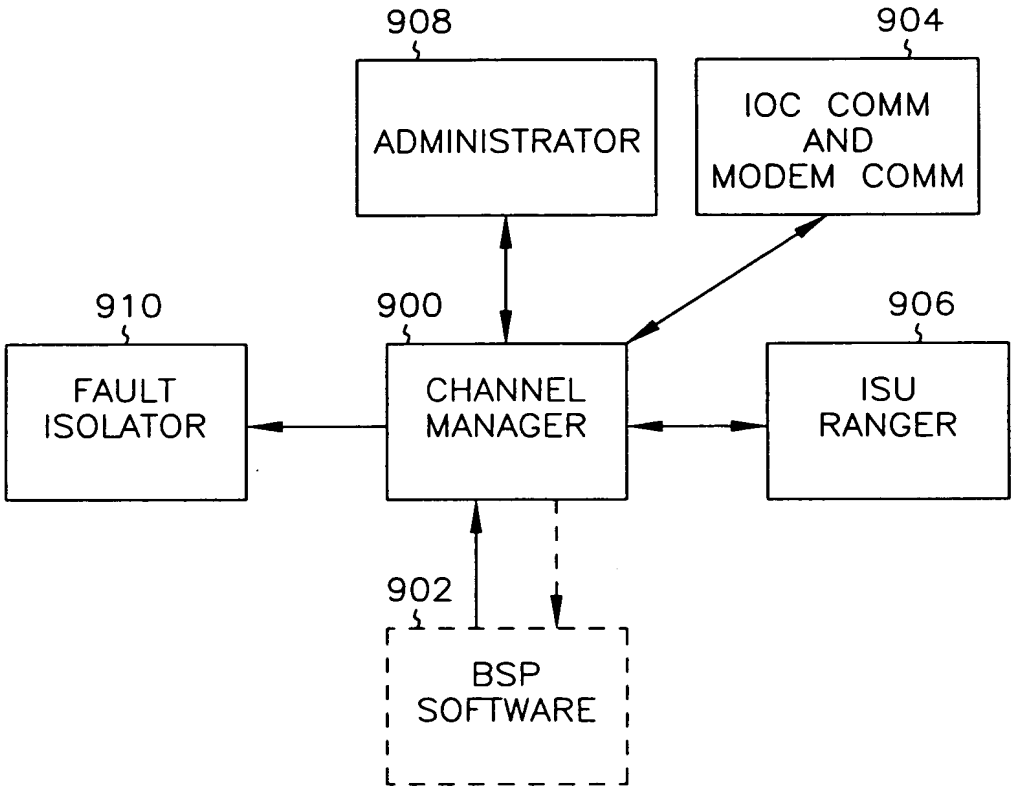


FIG. 59

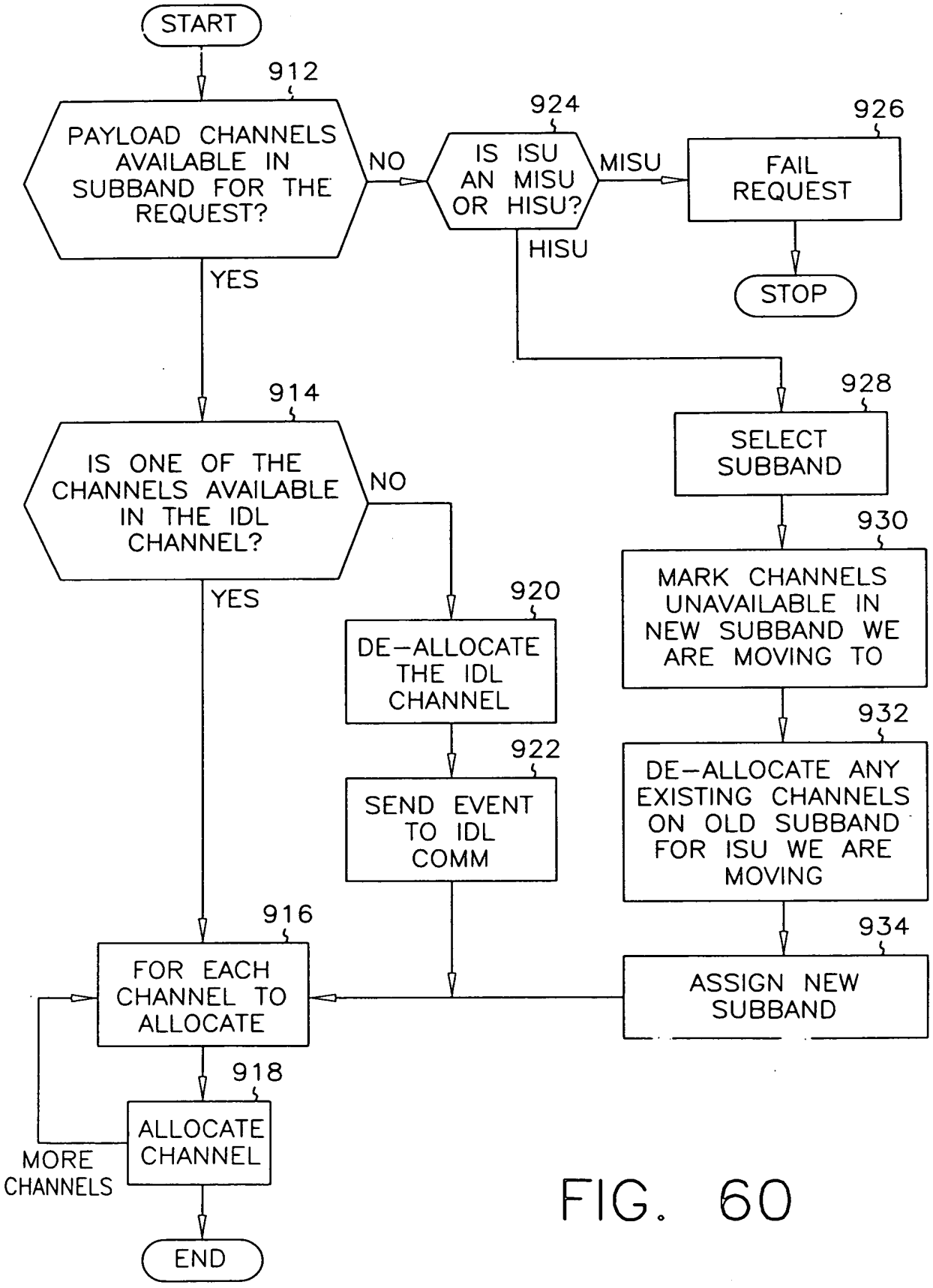

START
912
PAYLOAD CHANNELS AVAILABLE IN SUBBAND FOR THE REQUEST?
NO
924
IS ISU AN MISU OR HISU?
MISU
926
FAIL REQUEST
STOP
HISU
YES
914
IS ONE OF THE CHANNELS AVAILABLE IN THE IDL CHANNEL?
NO
YES
920
DE-ALLOCATE THE IDL CHANNEL
922
SEND EVENT TO IDL COMM
928
SELECT SUBBAND
930
MARK CHANNELS UNAVAILABLE IN NEW SUBBAND WE ARE MOVING TO
932
DE-ALLOCATE ANY EXISTING CHANNELS ON OLD SUBBAND FOR ISU WE ARE MOVING
934
ASSIGN NEW SUBBAND
916
FOR EACH CHANNEL TO ALLOCATE
918
ALLOCATE CHANNEL
MORE CHANNELS
END

FIG. 60

Docket No. PA990045

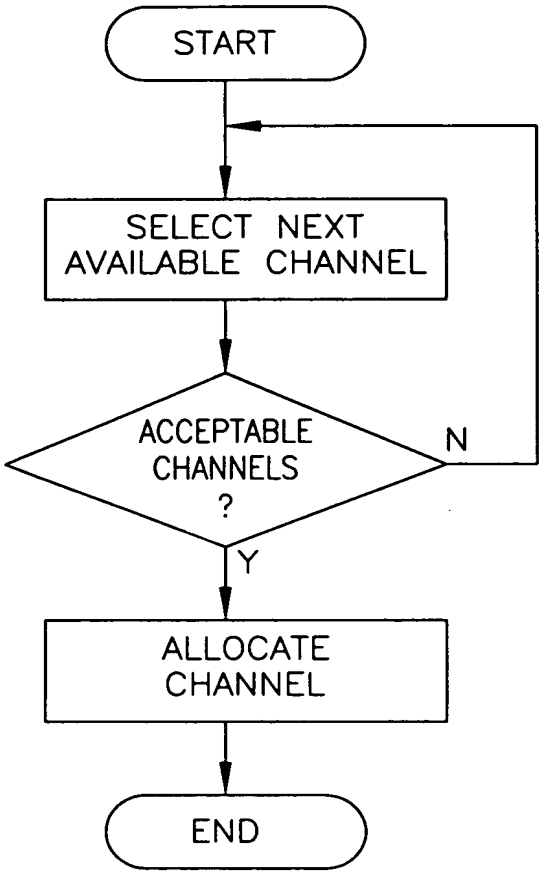


FIG. 61

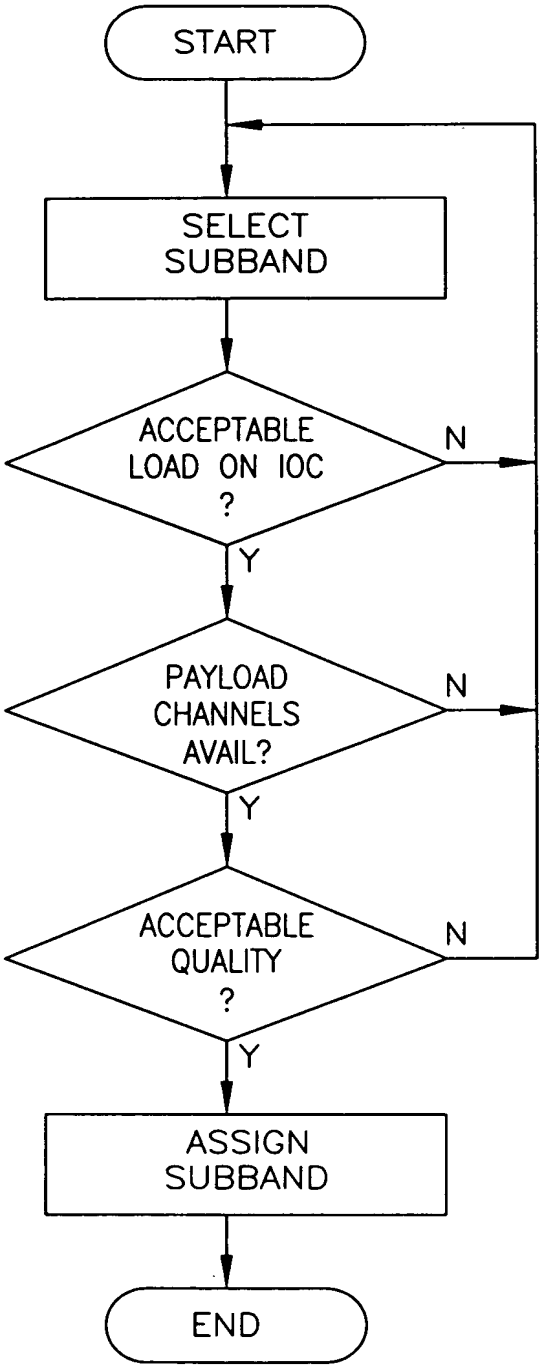

START
SELECT SUBBAND
ACCEPTABLE LOAD ON IOC ?
N
Y
PAYLOAD CHANNELS AVAIL?
N
Y
ACCEPTABLE QUALITY ?
N
Y
ASSIGN SUBBAND
END

FIG. 62

T06020"hZET0660

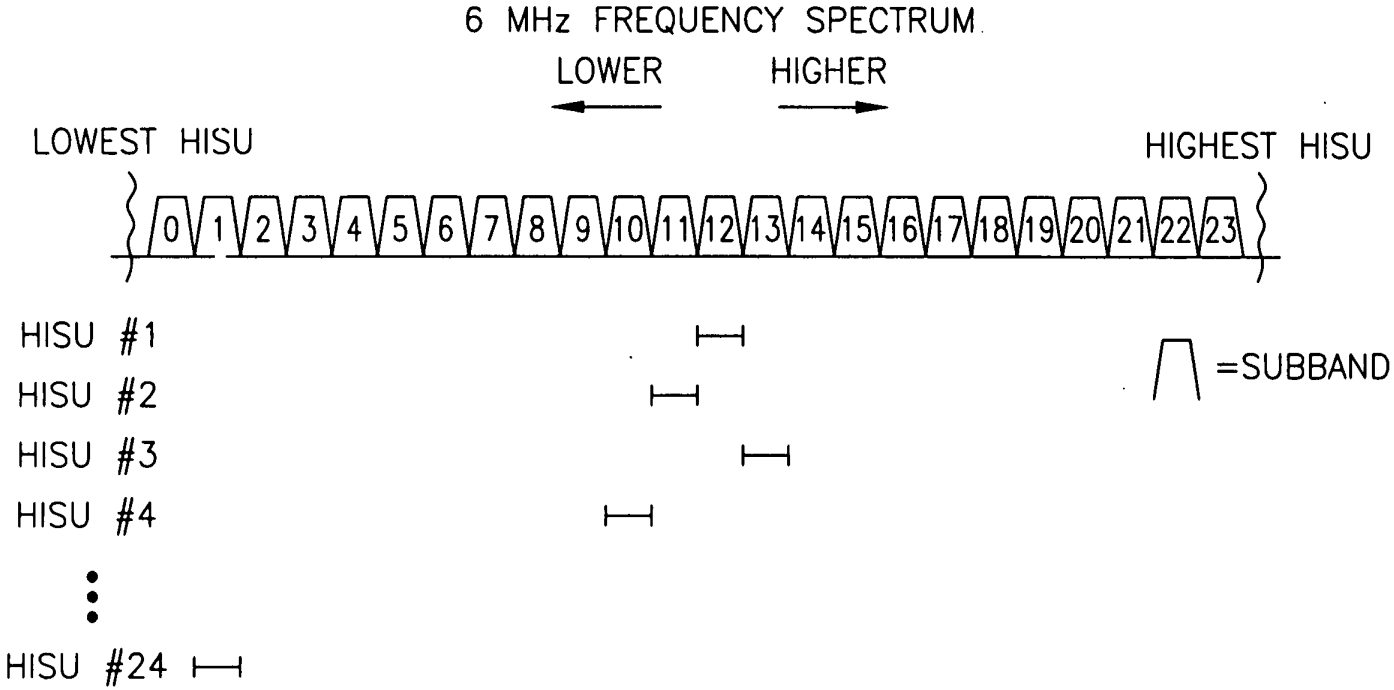


FIG. 63

T0620"h2ET060

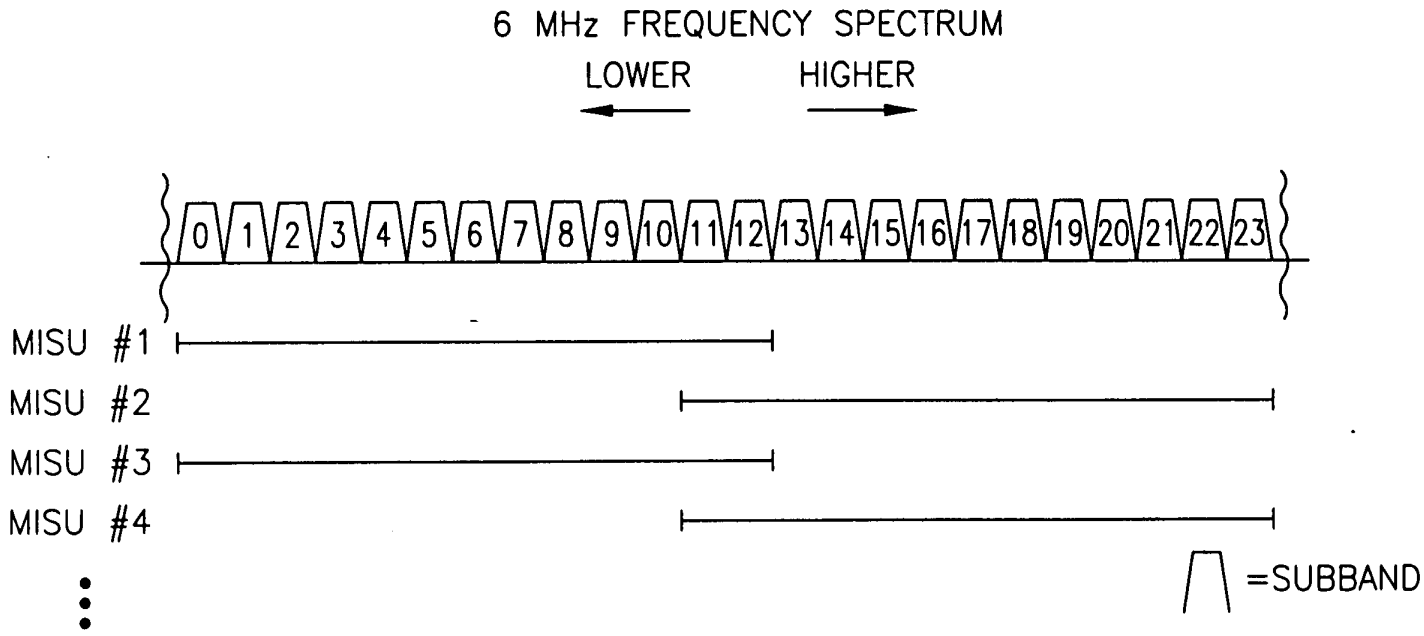


FIG. 64

T06020"t2ET0660

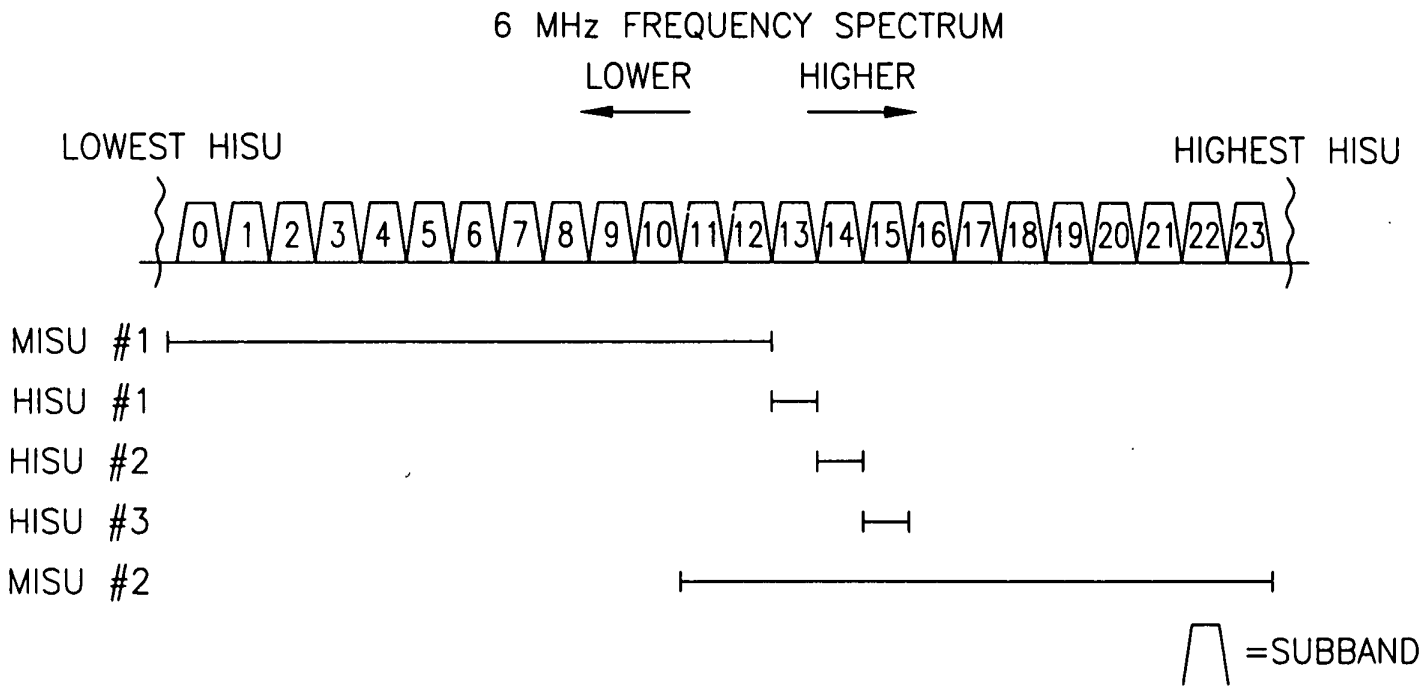


FIG. 65

T06020"h2ET0660

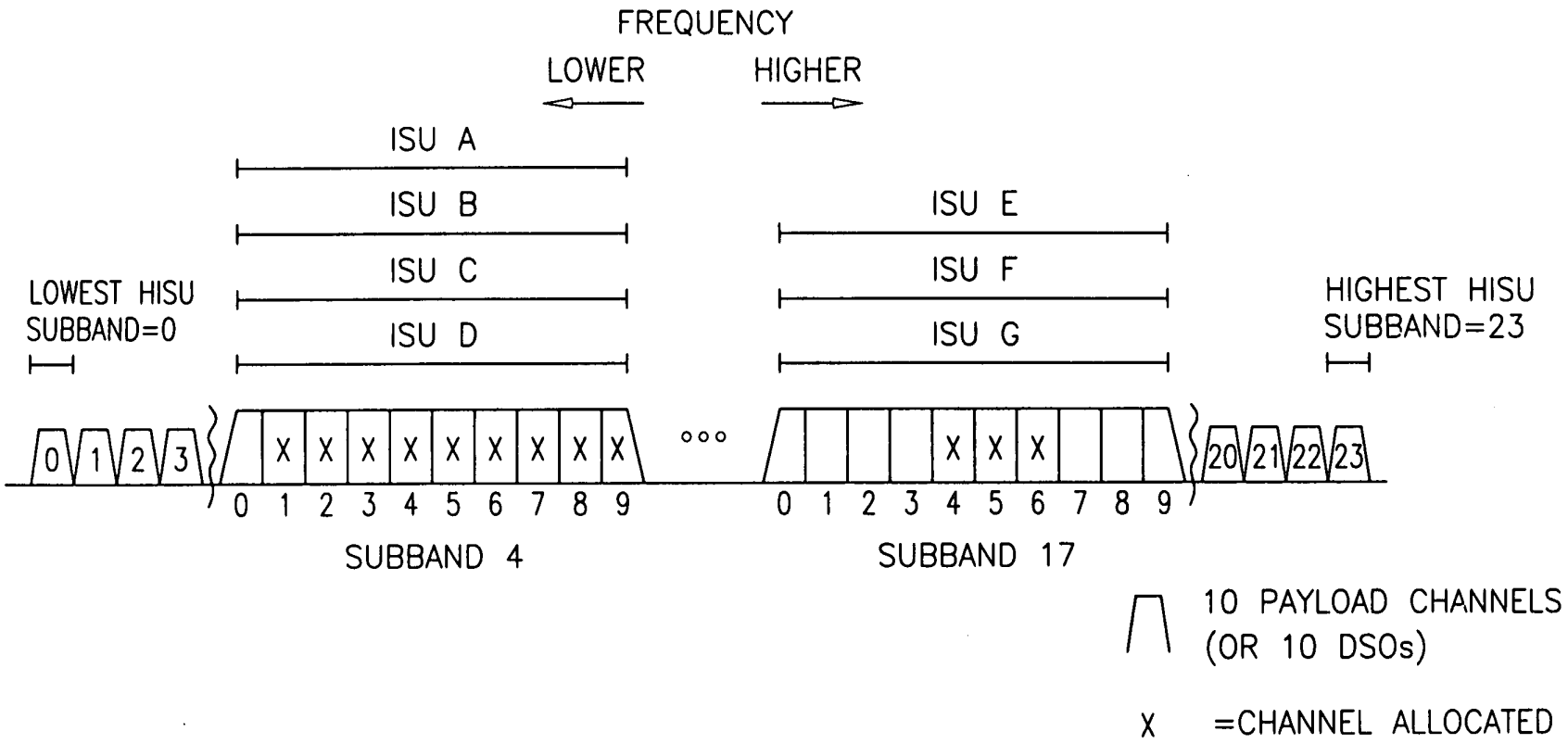


FIG. 66

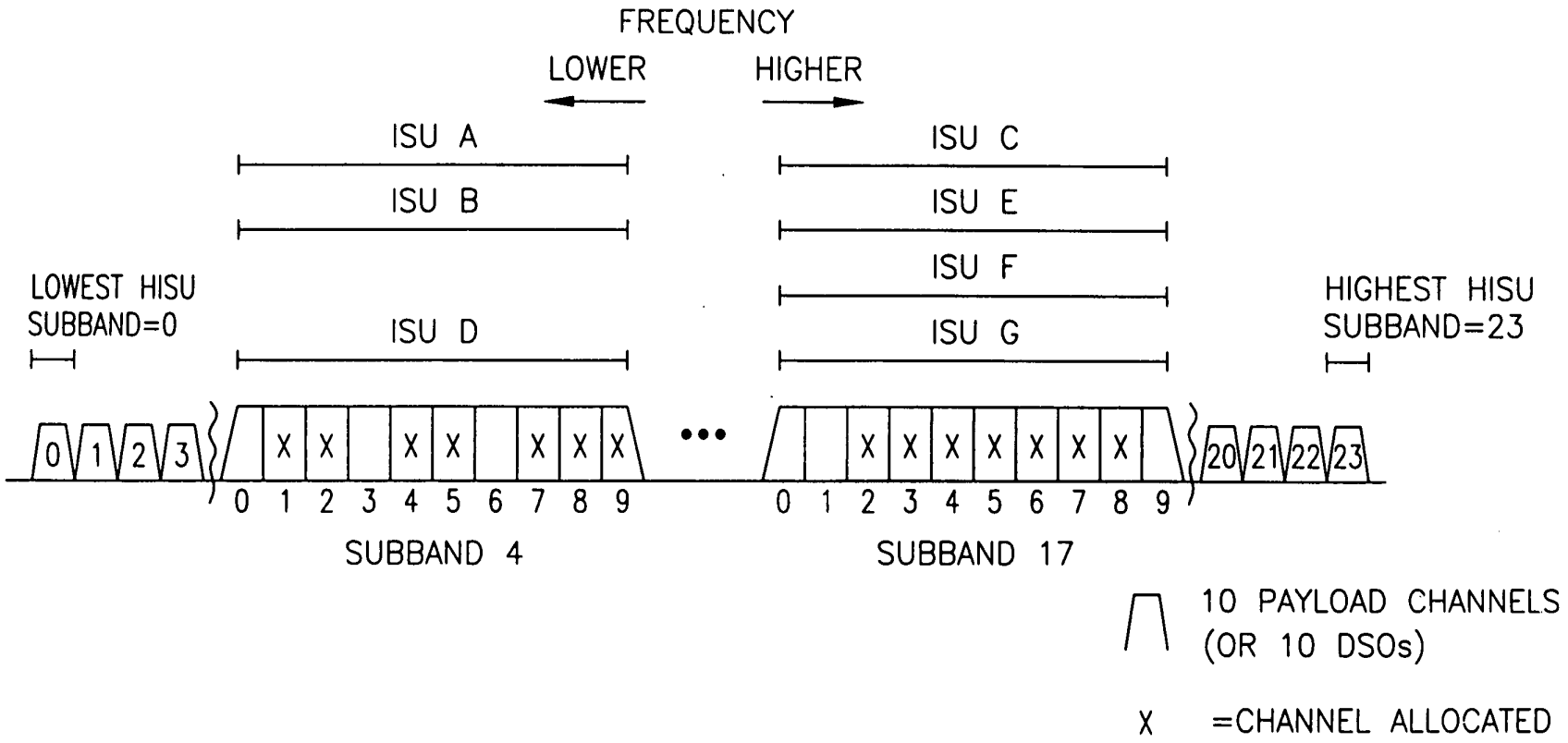

FREQUENCY
LOWER
HIGHER
ISU A
ISU B
ISU C
ISU E
ISU F
ISU G
ISU D
LOWEST HISU
SUBBAND=0
HIGHEST HISU
SUBBAND=23
0 1 2 3
X X X X X X X X X X
20 21 22 23
0 1 2 3 4 5 6 7 8 9
0 1 2 3 4 5 6 7 8 9
SUBBAND 4
SUBBAND 17
10 PAYLOAD CHANNELS
(OR 10 DSOs)
X =CHANNEL ALLOCATED

FIG. 67

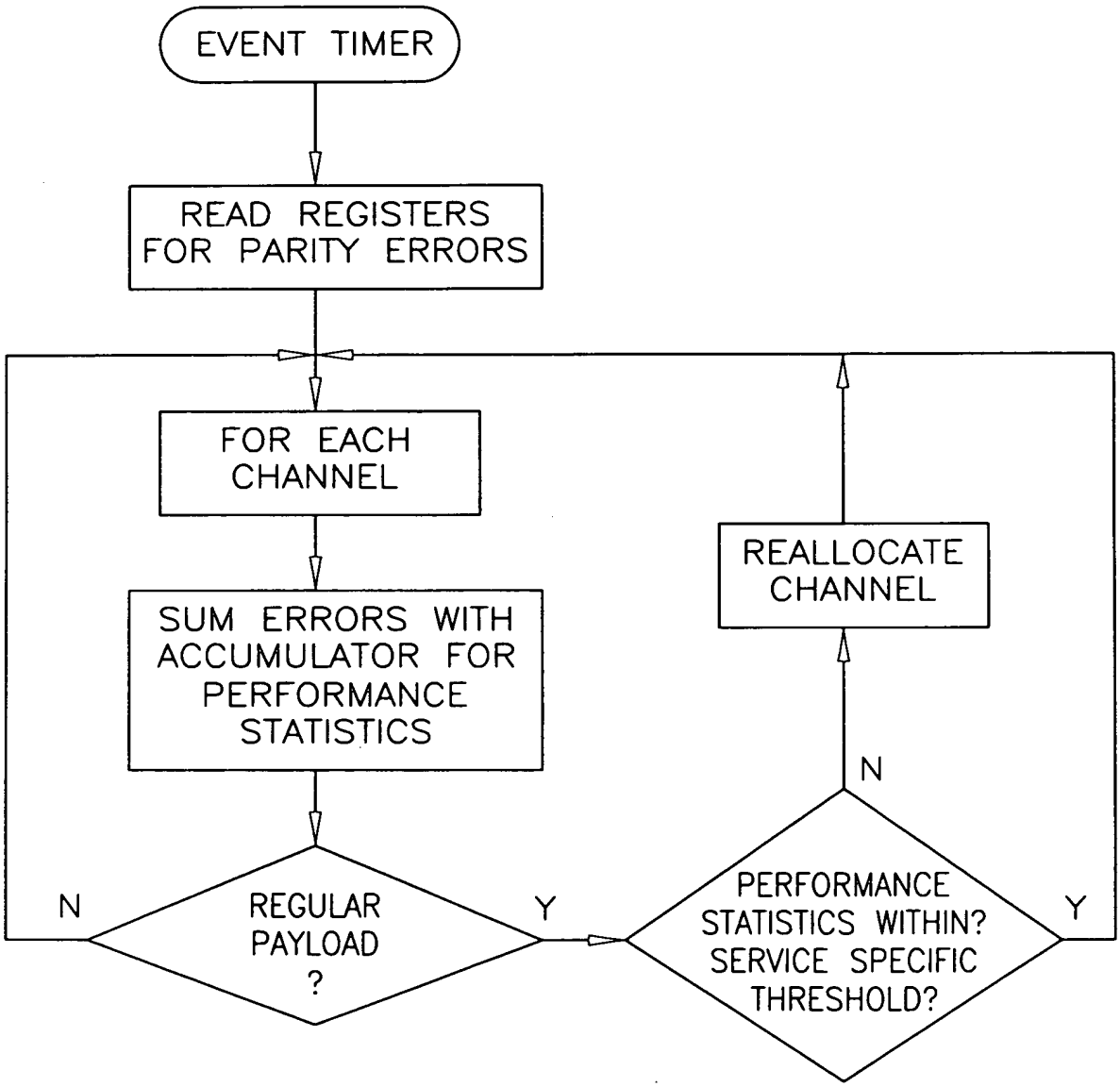

EVENT TIMER
READ REGISTERS FOR PARITY ERRORS
FOR EACH CHANNEL
SUM ERRORS WITH ACCUMULATOR FOR PERFORMANCE STATISTICS
REGULAR PAYLOAD ?
N
Y
PERFORMANCE STATISTICS WITHIN? SERVICE SPECIFIC THRESHOLD?
N
Y
REALLOCATE CHANNEL

FIG. 68

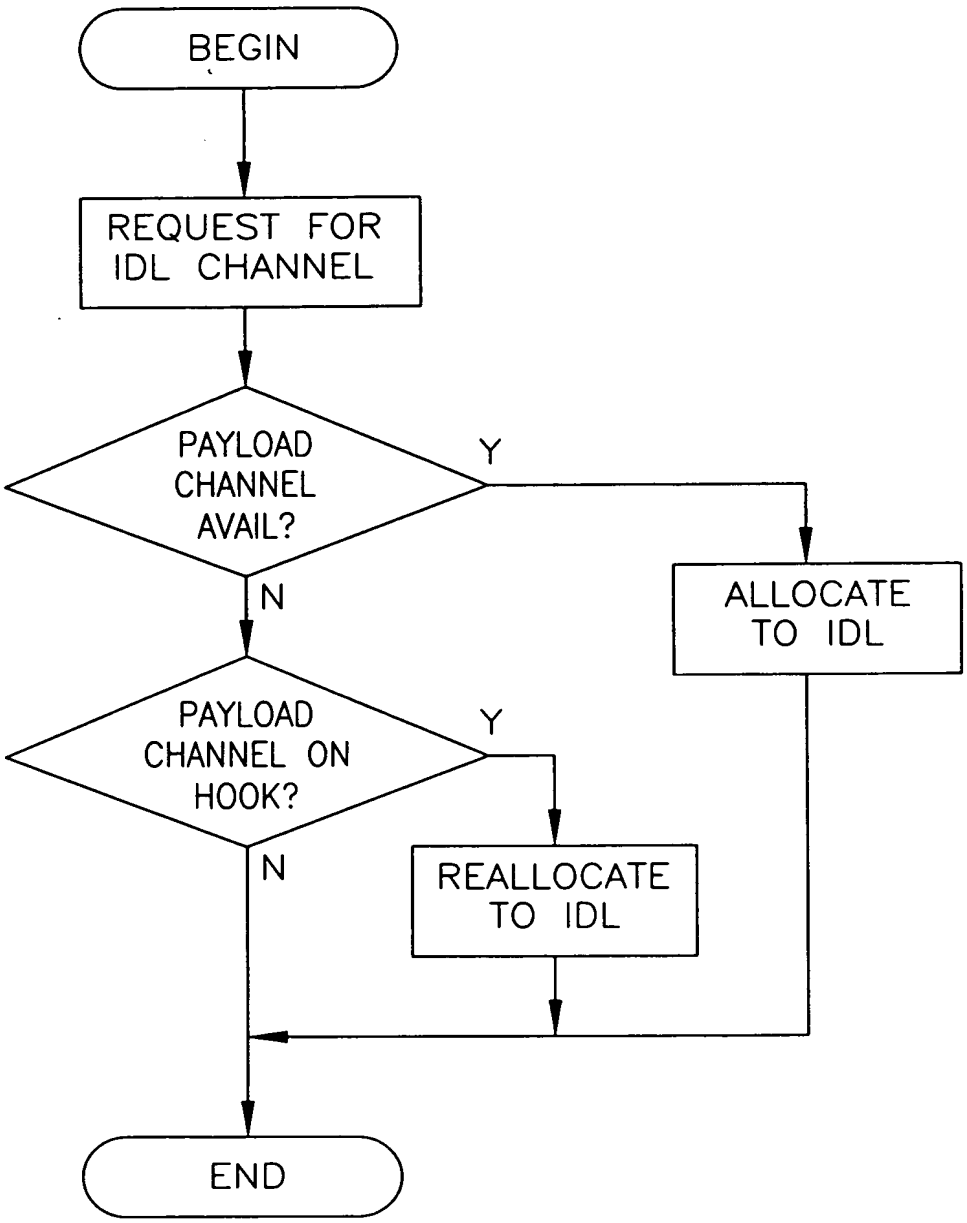

BEGIN
REQUEST FOR IDL CHANNEL
PAYLOAD CHANNEL AVAIL?
Y
N
ALLOCATE TO IDL
PAYLOAD CHANNEL ON HOOK?
Y
N
REALLOCATE TO IDL
END

FIG. 69

T06020"h2ET0660

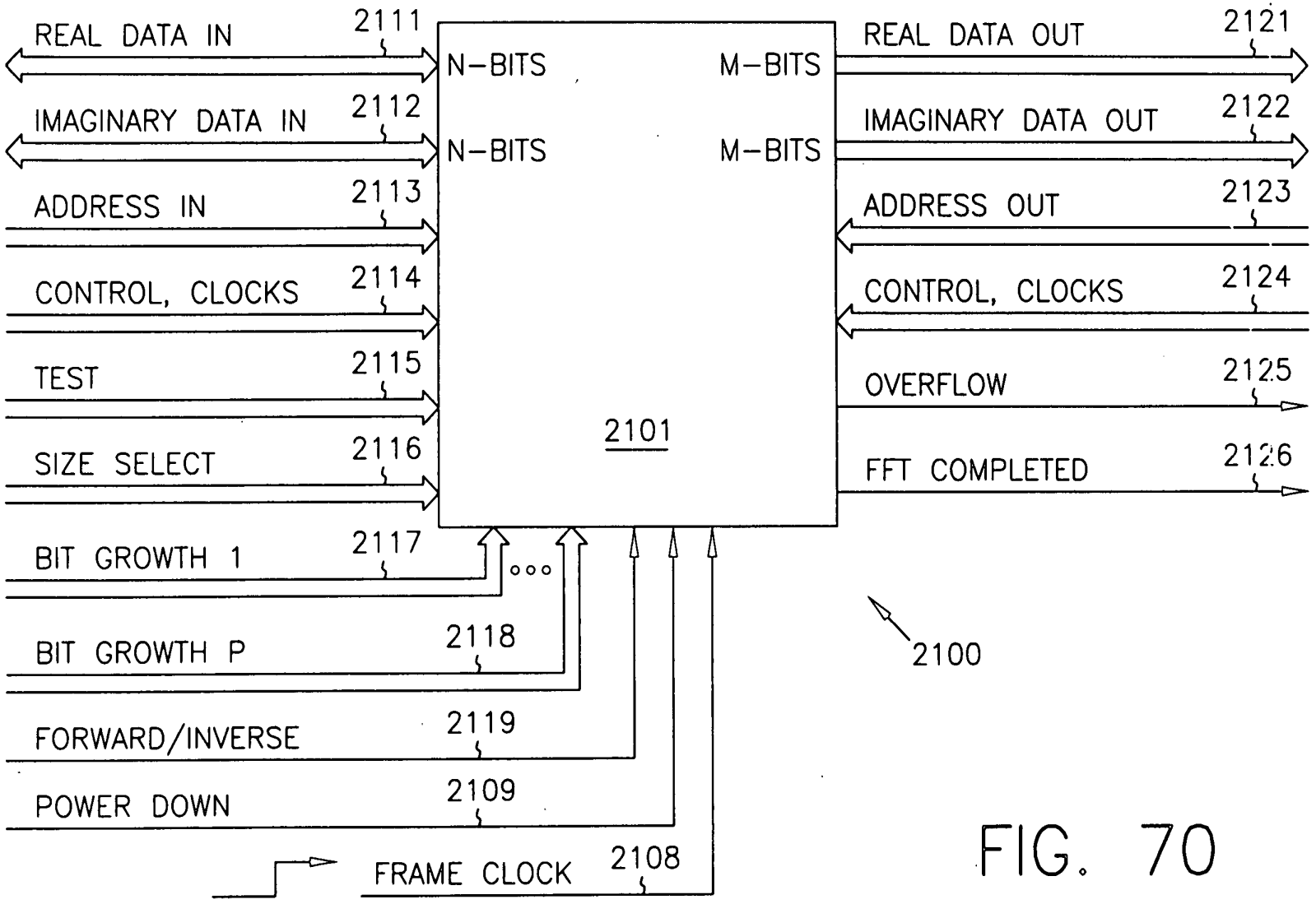


FIG. 70

TOCD20"h2ET068

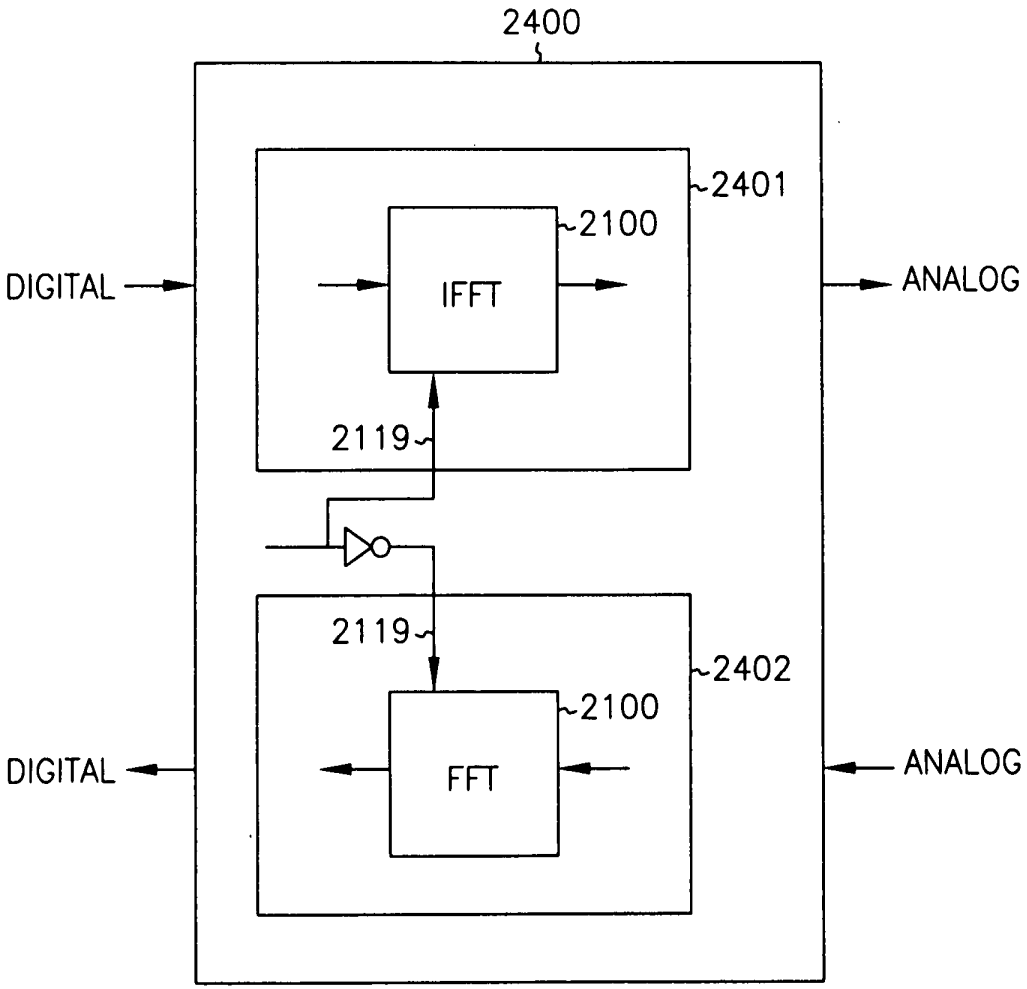


FIG. 71

T06020 "42T0660

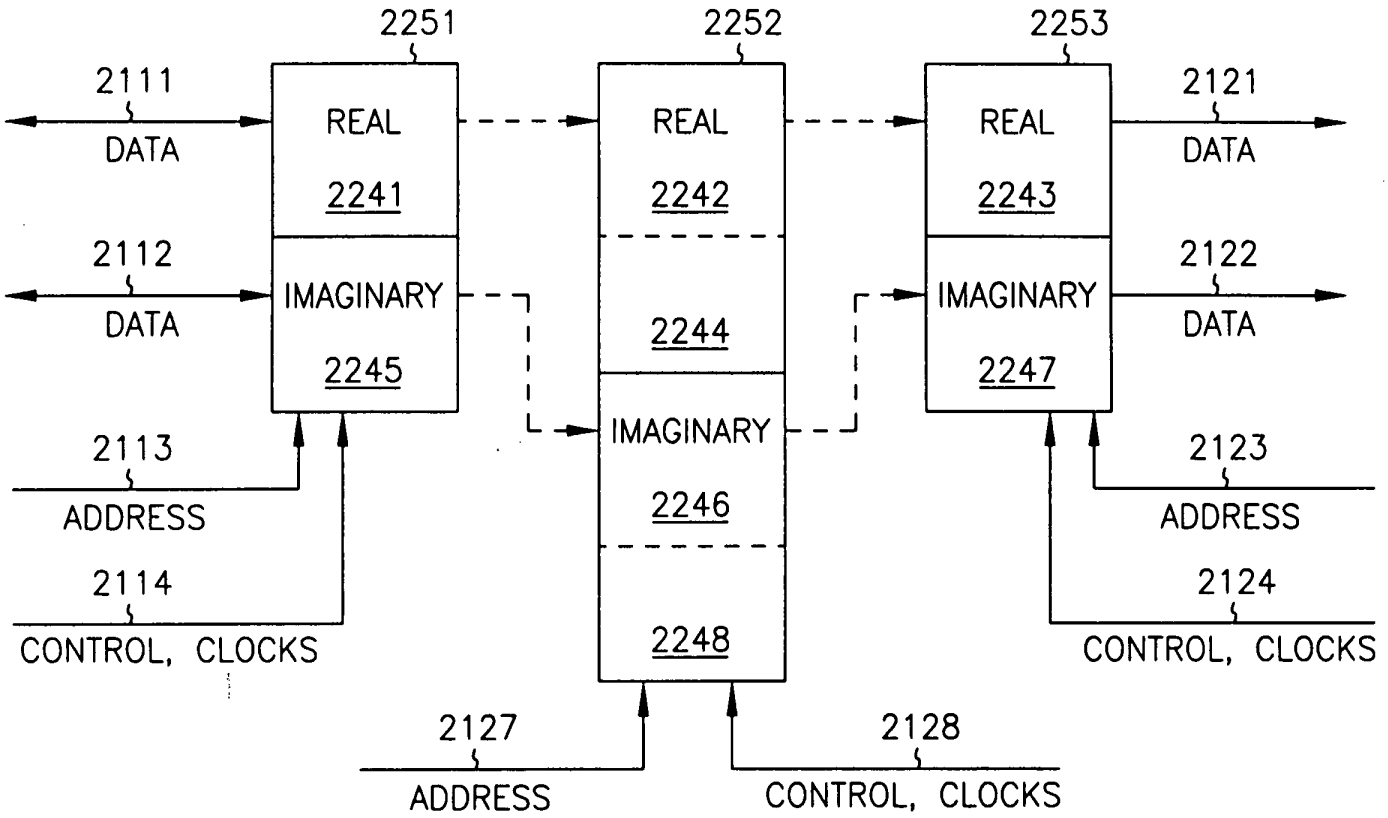


FIG. 72

T06020 "42T0660

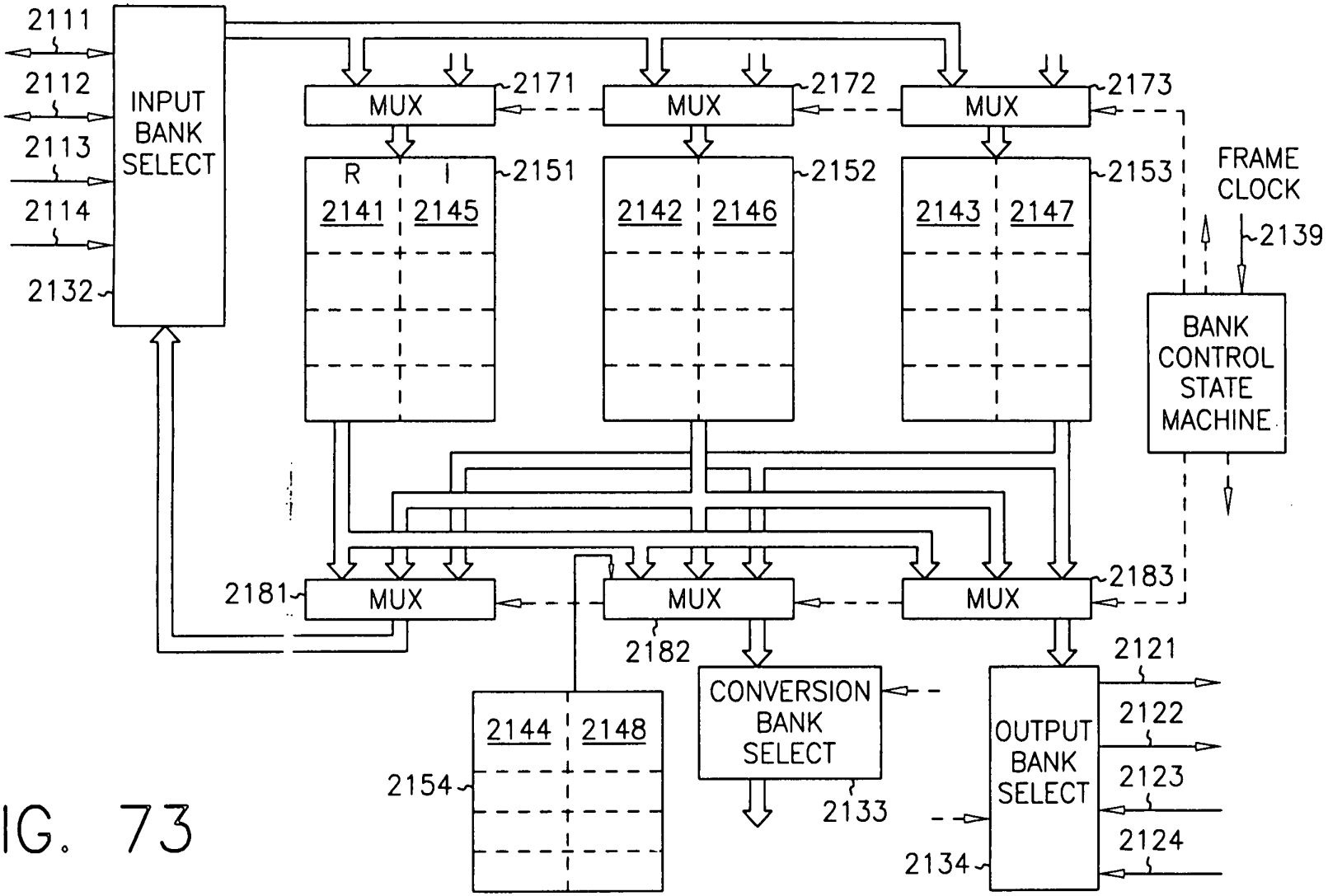
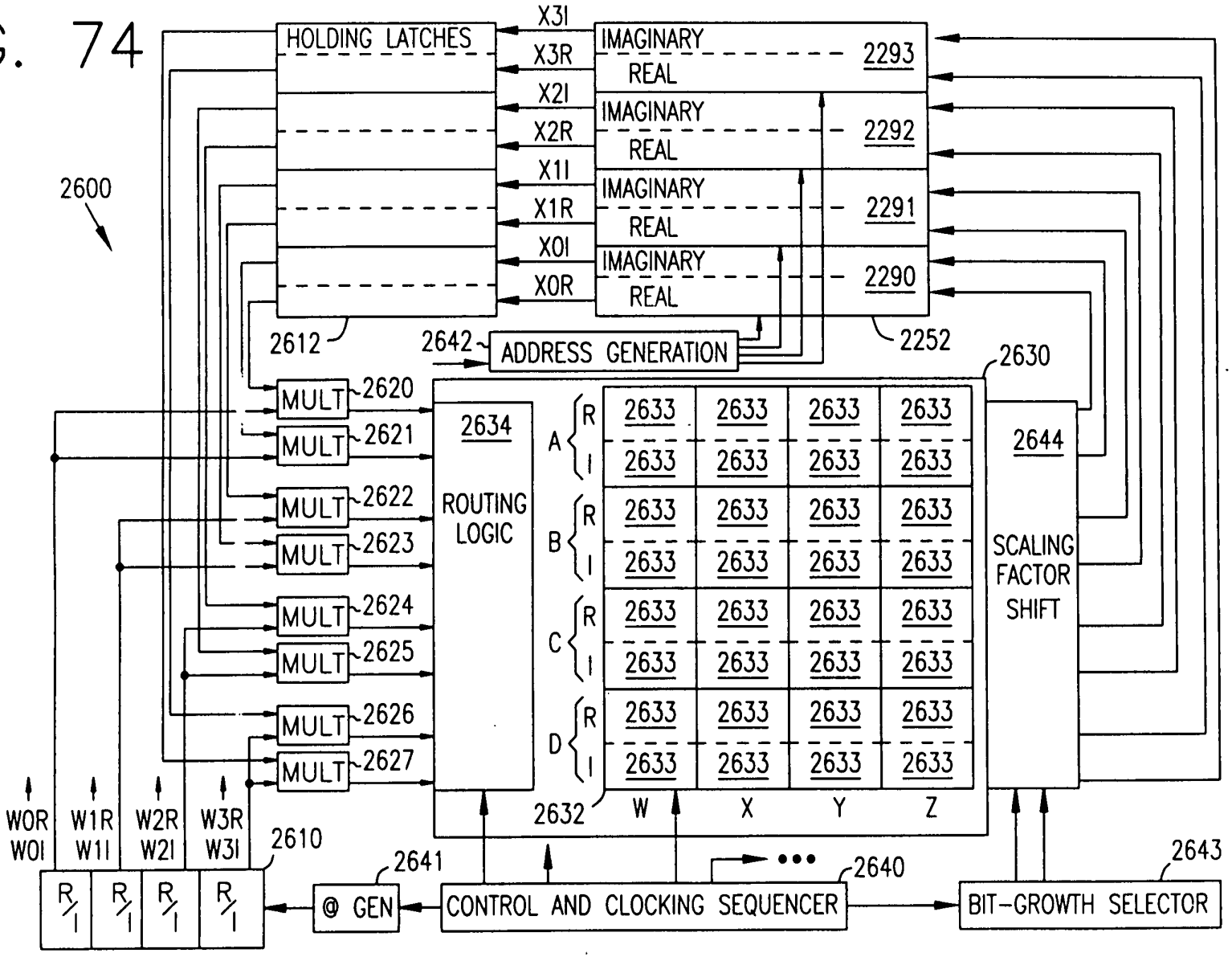


FIG. 73

TOSZO"hZETOGO

FIG. 74



THIS TABLE SHOWS THE ORDER OF CALCULATION FOR A TRANSPOSED BUTTERFLY:

C0

AWR=WR AWI =WI	AXR =XR AXI =XI	AYR =YR AYI =YI	AZR =ZR AZI =ZI
BWR=WR BWI =WI	BXR=XR BXI =XI	BYR =YR BYI =YI	BZR=ZR BZI =ZI
CWR=WR CWI =WI	CXR=XR CXI =XI	CYR =YR CYI =YI	CZR=ZR CZI =ZI
DWR =WR DWI =WI	DXR=XR DXI =XI	DYR=YR DYI =YI	DZR=ZR DZI =ZI

~2632

2800

FIG. 75

CI

AWR=AWR −WI AWI=AWI +WR	AXR=AXR −XI AXI=AXI +XR	AYR=AYR −YI AYI=AYI +YR	AZR=AZR −ZI AZI=AZI +ZR
BWR=BWR−WI BWI=BWI +WR	BXR=BXR −XI BXI=BXI +XR	BYR=BYR −YI BYI=BYI +YR	BZR=BZR −ZI BZI=BZI +ZR
CWR=CWR−WI CWI=CWI +WR	CXR=CXR −XI CXI=CXI +XR	CYR=CYR −YI CYI=CYI +YR	CZR=CZR −ZI CZI=CZI +ZR
DWR=DWR−WI DWI=DWI +WR	DXR=DXR −XI DXI=DXI +XR	DYR=DYR −YI DYI=DYI +YR	DZR=DZR −ZI DZI=DZI +ZR

~2632

2800

FIG. 76

C2

AWR=AWR +WR AWI=AWI +WI	AXR=AXR +XI AXI=AXI −XR	AYR=AYR −YR AYI=AYI −YI	AZR=AZR −ZI AZI=AZI +ZR
BWR=BWR+WR BWI=BWI +WI	BXR=BXR +XI BXI=BXI −XR	BYR=BYR −YR BYI=BYI −YI	BZR=BZR −ZI BZI=BZI +ZR
CWR=CWR+WR CWI=CWI +WI	CXR=CXR +XI CXI=CXI −XR	CYR=CYR −YR CYI=CYI −YI	CZR=CZR −ZI CZI=CZI +ZR
DWR=DWR+WR DWI=DWI +WI	DXR=DXR +XI DXI=DXI −XR	DYR=DYR −YR DYI=DYI −YI	DZR=DZR −ZI DZI=DZI +ZR

2632

2800

FIG. 77

C3

AWR=AWR −WI AWI=AWI +WR	AXR=AXR +XR AXI=AXI +XI	AYR=AYR +YI AYI=AYI −YR	AZR=AZR −ZR AZI=AZI −ZI
BWR=BWR−WI BWI=BWI +WR	BXR=BXR +XR BXI=BXI +XI	BYR=BYR +YI BYI=BYI −YR	BZR=BZR −ZR BZI=BZI −ZI
CWR=CWR−WI CWI=CWI +WR	CXR=CXR +XR CXI=CXI +XI	CYR=CYR +YI CYI=CYI −YR	CZR=CZR −ZR CZI=CZI −ZI
DWR=DWR−WI DWI=DWI +WR	DXR=DXR +XR DXI=DXI +XI	DYR=DYR +YI DYI=DYI −YR	DZR=DZR −ZR DZI=DZI −ZI

2632

2800

FIG. 78

C4

AWR=AWR +WR AWI=AWI +WI	AXR=AXR --XR AXI=AXI −XI	AYR=AYR +YR AYI=AYI +YI	AZR=AZR −ZR AZI=AZI −ZI
BWR=BWR+WR BWI=BWI +WI	BXR=BXR −XR BXI=BXI −XI	BYR=BYR +YR BYI=BYI +YI	BZR=BZR −ZR BZI=BZI −ZI
CWR=CWR+WR CWI=CWI +WI	CXR=CXR −XR CXI=CXI −XI	CYR=CYR +YR CYI=CYI +YI	CZR=CZR −ZR CZI=CZI −ZI
DWR=DWR+WR DWI=DWI +WI	DXR=DXR −XR DXI=DXI −XI	DYR=DYR +YR DYI=DYI +YI	DZR=DZR −ZR DZI=DZI −ZI

~2632

2800

FIG. 79

C5

AWR=AWR −WI AWI=AWI +WR	AXR=AXR +XI AXI=AXI −XR	AYR=AYR −YI AYI=AYI +YR	AZR=AZR +ZI AZI=AZI −ZR
BWR=BWR−WI BWI=BWI +WR	BXR=BXR +XI BXI=BXI −XR	BYR=BYR −YI BYI=BYI +YR	BZR=BZR +ZI BZI=BZI −ZR
CWR=CWR−WI CWI=CWI +WR	CXR=CXR +XI CXI=CXI −XR	CYR=CYR −YI CYI=CYI +YR	CZR=CZR +ZI CZI=CZI −ZR
DWR=DWR−WI DWI=DWI +WR	DXR=DXR +XI DXI=DXI −XR	DYR=DYR −YI DYI=DYI +YR	DZR=DZR +ZI DZI=DZI −ZR

~2632

2800

FIG. 80

C6

AWR=AWR +WR AWI=AWI +WI	AXR=AXR −XI AXI=AXI +XR	AYR=AYR −YR AYI=AYI −YI	AZR=AZR +ZI AZI=AZI −ZR
BWR=BWR+WR BWI=BWI +WI	BXR=BXR −XI BXI=BXI +XR	BYR=BYR −YR BYI=BYI −YI	BZR=BZR +ZI BZI=BZI −ZR
CWR=CWR+WR CWI=CWI +WI	CXR=CXR −XI CXI=CXI +XR	CYR=CYR −YR CYI=CYI −YI	CZR=CZR +ZI CZI=CZI −ZR
DWR=DWR+WR DWI=DWI +WI	DXR=DXR −XI DXI=DXI +XR	DYR=DYR −YR DYI=DYI −YI	DZR=DZR +ZI DZI=DZI −ZR

~2632

2800

FIG. 81

C7

AWR=AWR −WI AWI=AWI +WR	AXR=AXR −XR AXI=AXI −XI	AYR=AYR +YI AYI=AYI −YR	AZR=AZR −ZR AZI=AZI +ZI
BWR=BWR−WI BWI=BWI +WR	BXR=BXR −XR BXI=BXI −XI	BYR=BYR +YI BYI=BYI −YR	BZR=BZR −ZR BZI=BZI +ZI
CWR=CWR−WI CWI=CWI +WR	CXR=CXR −XR CXI=CXI −XI	CYR=CYR +YI CYI=CYI −YR	CZR=CZR −ZR CZI=CZI +ZI
DWR=DWR−WI DWI=DWI +WR	DXR=DXR −XR DXI=DXI −XI	DYR=DYR +YI DYI=DYI −YR	DZR=DZR −ZR DZI=DZI +ZI

~2632

2800

FIG. 82

THIS TABLE SHOWS THE ORDER OF CALCULATION FOR A TRANSPOSED BUTTERFLY:

C0

2632

AWR =WR+XR+YR+ZR AWI =WI+XI+YI+ZI	AXR =WR−XI−YR+ZI AXI =WI+XR−YI−ZR	AYR =WR−XR+YR−ZR AYI =WI−XI+YI−ZI	AZR =WR+XI−YR−ZI AZI =WI−XR−YI+ZR
− −	− −	− −	− −
− −	− −	− −	− −
− −	− −	− −	− −

2810

FIG. 83

C1

2632

AWR =AWR−(WI+XI+YI+ZI) AWI =AWI+(WR+XR+YR+ZR)	AXR =AXR−(WI+XR−YI−ZR) AXI =AXI+(WR−XI−YR+ZI)	AYR =AYR−(WI−XI+YI−ZI) AYI =AYI+(WR−XR+YR−ZR)	AZR =AZR−(WI−XR−YI+ZR) AZI =AZI+(WR+XI−YR−ZI)
− −	− −	− −	− −
− −	− −	− −	− −
− −	− −	− −	− −

2810

FIG. 84

C2

2632

– –	– –	– –	– –
BWR =WR+XR+YR+ZR BWI =WI+XI+YI+ZI	BXR =WR−XI−YR+ZI BXI =WI+XR−YI−ZR	BYR =WR−XR+YR−ZR BYI =WI−XI+YI−ZI	BZR =WR+XI−YR−ZI BZI =WI−XR−YI+ZR
– –	– –	– –	– –
– –	– –	– –	– –

2810

FIG. 85

C3

2632

– –	– –	– –	– –
BWR =BWR−(WI+XI+YI+ZI) BWI =BWI+(WR+XR+YR+ZR)	BXR =BXR−(WI+XR−YI−ZR) BXI =BXI+(WR−XI−YR+ZI)	BYR =BYR−(WI−XI+YI−ZI) BYI =BYI+(WR−XR+YR−ZR)	BZR =BZR−(WI−XR−YI+ZR) BZI =BZI+(WR+XI−YR−ZI)
– –	– –	– –	– –
– –	– –	– –	– –

2810

FIG. 86

C4

2632

2810

– –	– –	– –	– –
– –	– –	– –	– –
CWR =WR+XR+YR+ZR CWI =WI+XI+YI+ZI	CXR =WR−XI−YR+ZI CXI =WI+XR−YI−ZR	CYR =WR−XR+YR−ZR CYI =WI−XI+YI−ZI	CZR =WR+XI−YR−ZI CZI =WI−XR−YI+ZR
– –	– –	– –	– –

FIG. 87

C5

2632

2810

– –	– –	– –	– –
– –	– –	– –	– –
CWR =CWR−(WI+XI+YI+ZI) CWI =CWI+(WR+XR+YR+ZR)	CXR =CXR−(WI+XR−YI−ZR) CXI =CXI+(WR−XI−YR+ZI)	CYR =CYR−(WI−XI+YI−ZI) CYI =CYI+(WR−XR+YR−ZR)	CZR =CZR−(WI−XR−YI+ZR) CZI =CZI+(WR+XI−YR−ZI)
– –	– –	– –	– –

FIG. 88

C6

2632

– –	– –	– –	– –
– –	– –	– –	– –
– –	– –	– –	– –
DWR =WR+XR+YR+ZR DWI =WI+XI+YI+ZI	DXR =WR−XI−YR+ZI DXI =WI+XR−YI−ZR	DYR =WR−XR+YR−ZR DYI =WI−XI+YI−ZI	DZR =WR+XI−YR−ZI DZI =WI−XR−YI+ZR

2810

FIG. 89

C7

2632

– –	– –	– –	– –
– –	– –	– –	– –
– –	– –	– –	– –
DWR =DWR−(WI+XI+YI+ZI) DWI =DWI+(WR+XR+YR+ZR)	DXR =DXR−(WI+XR−YI−ZR) DXI =DXI+(WR−XI−YR+ZI)	DYR =DYR−(WI−XI+YI−ZI) DYI =DYI+(WR−XR+YR−ZR)	DZR =DZR−(WI−XR−YI+ZR) DZI =DZI+(WR+XI−YR−ZI)

2810

FIG. 90

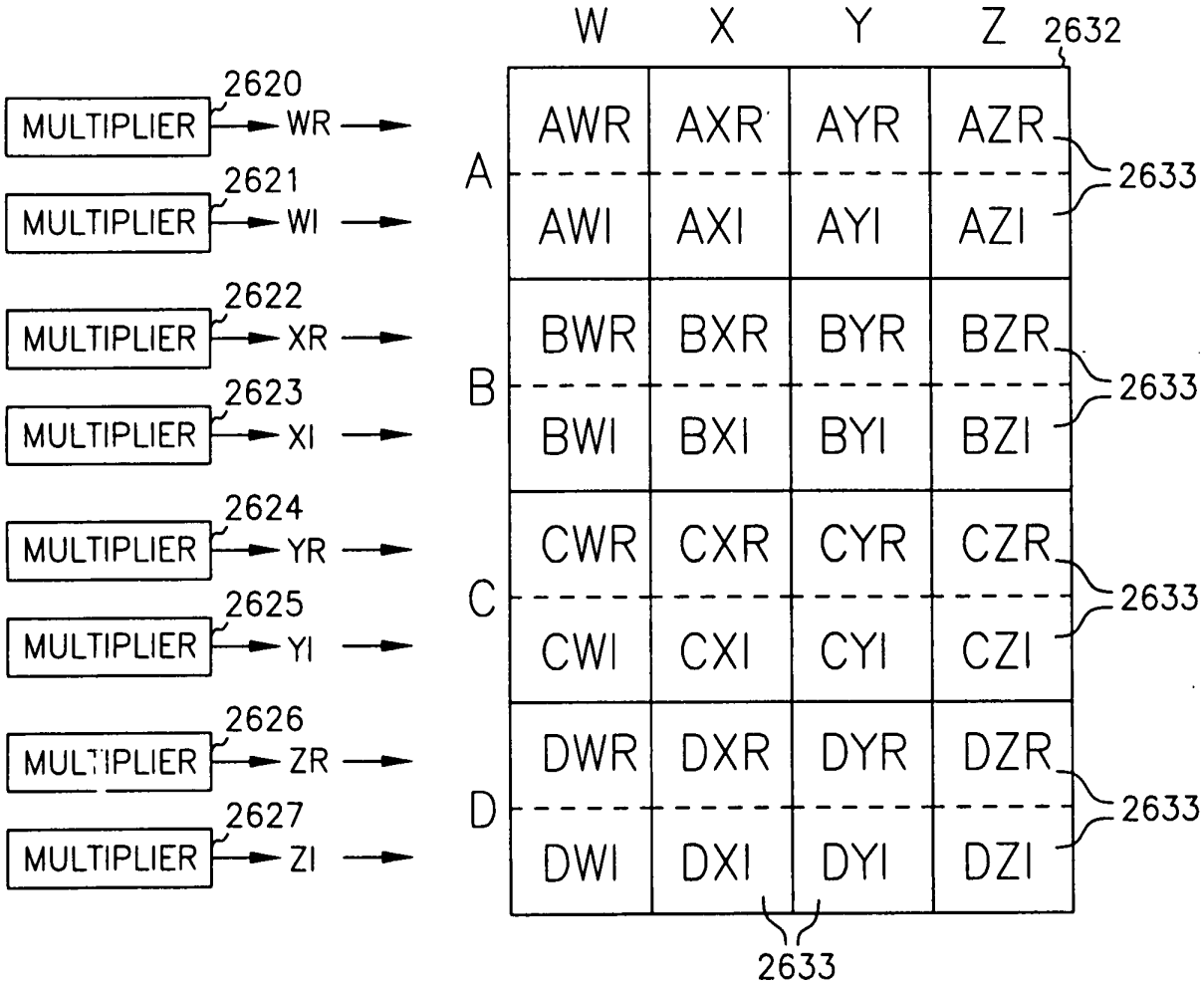

MULTIPLIER
2620
WR
2621
WI
2622
XR
2623
XI
2624
YR
2625
YI
2626
ZR
2627
ZI
W
X
Y
Z
2632
A
B
C
D
AWR
AXR
AYR
AZR
AWI
AXI
AYI
AZI
BWR
BXR
BYR
BZR
BWI
BXI
BYI
BZI
CWR
CXR
CYR
CZR
CWI
CXI
CYI
CZI
DWR
DXR
DYR
DZR
DWI
DXI
DYI
DZI
2633
2633
2633
2633

FIG. 91

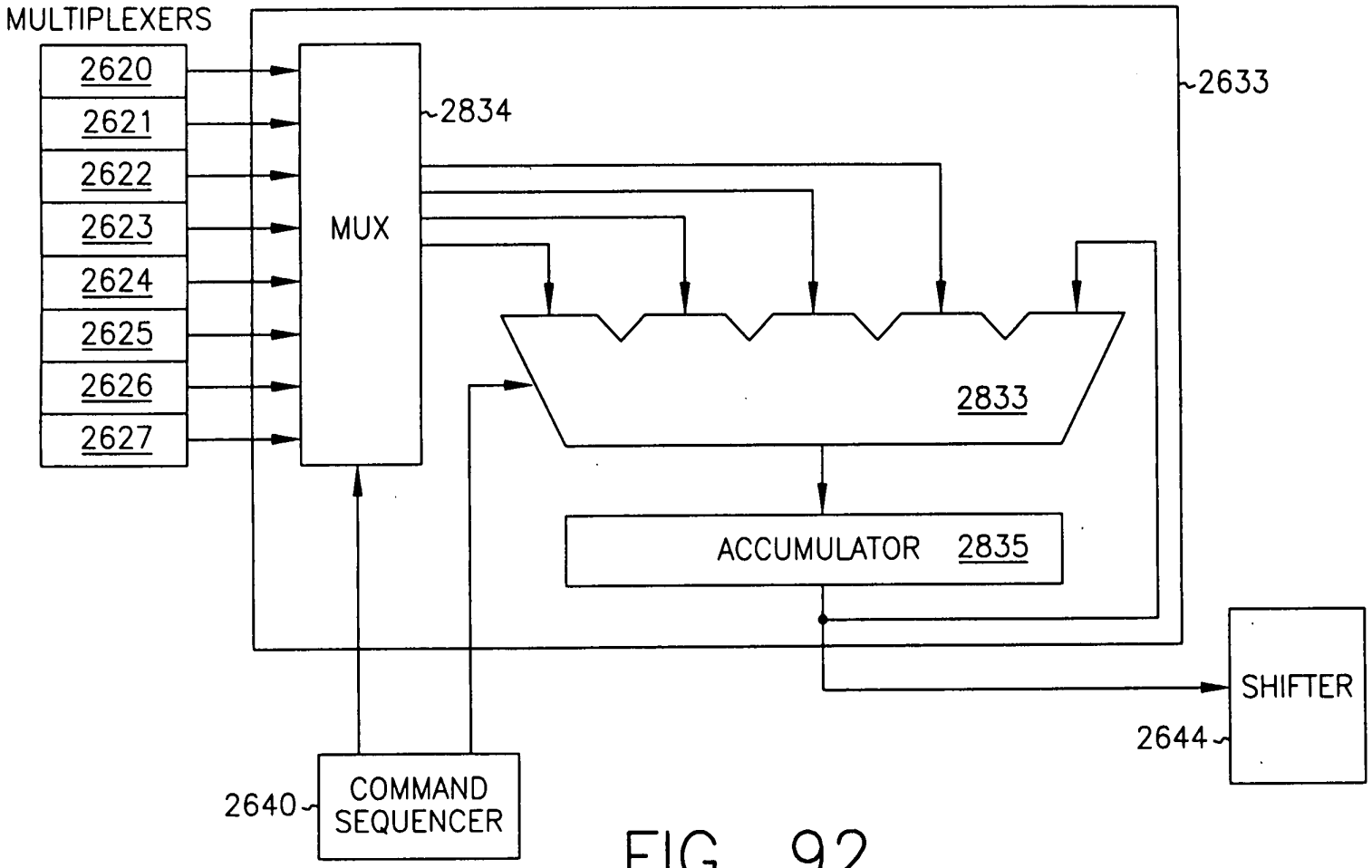

MULTIPLEXERS
2620
2621
2622
2623
2624
2625
2626
2627
MUX
2834
2633
2833
ACCUMULATOR 2835
SHIFTER
2644
2640
COMMAND SEQUENCER

FIG. 92

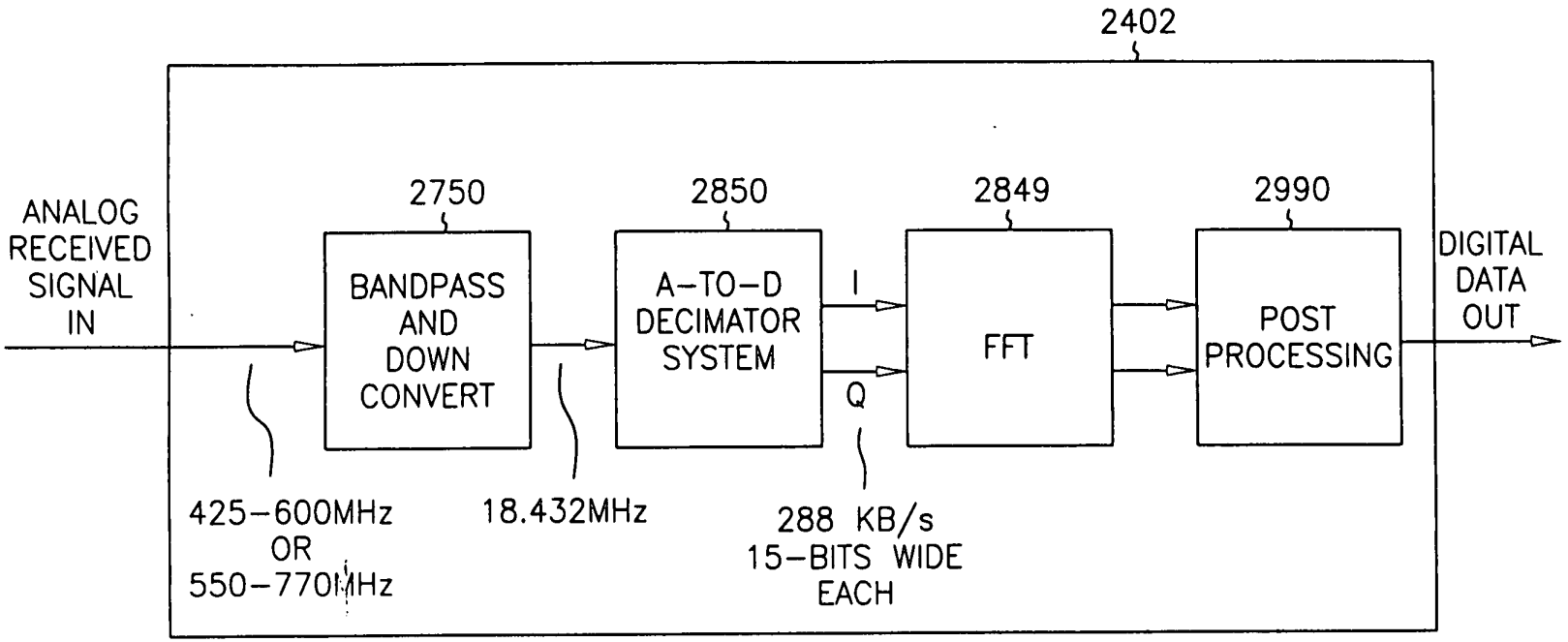

2402
ANALOG RECEIVED SIGNAL IN
2750
BANDPASS AND DOWN CONVERT
2850
A-TO-D DECIMATOR SYSTEM
I
Q
2849
FFT
2990
POST PROCESSING
DIGITAL DATA OUT
425-600MHz OR 550-770MHz
18.432MHz
288 KB/s 15-BITS WIDE EACH

FIG. 93

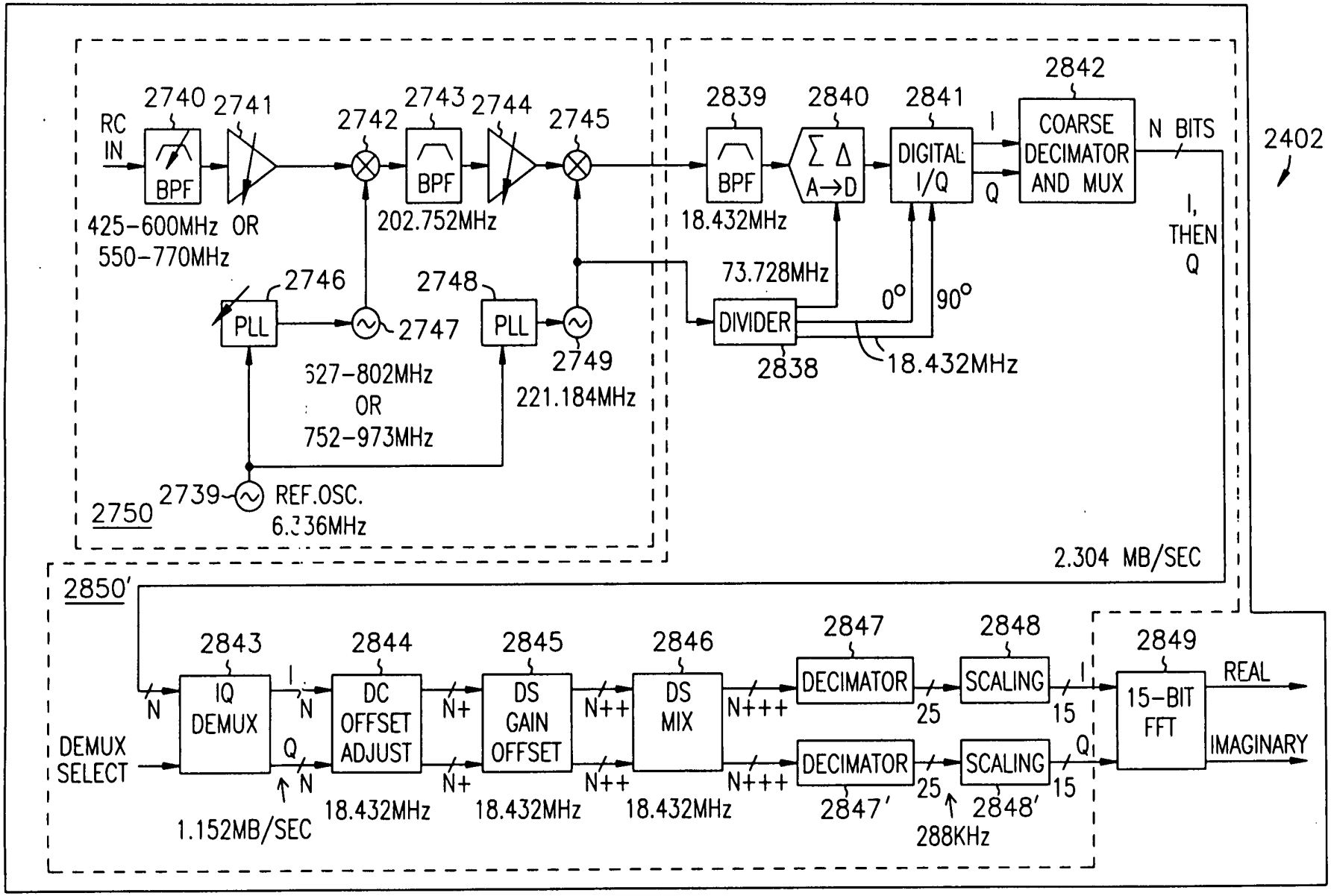

RC IN
2740
2741
2742
2743
2744
2745
BPF
425-600MHz OR
550-770MHz
202.752MHz
2746
PLL
2747
527-802MHz
OR
752-973MHz
2748
PLL
2749
221.184MHz
2739
REF.OSC.
6.336MHz
2750
2839
2840
2841
2842
BPF
18.432MHz
Σ Δ
A→D
DIGITAL
I/Q
I
Q
COARSE
DECIMATOR
AND MUX
N BITS
I,
THEN
Q
2402
73.728MHz
DIVIDER
2838
0°
90°
18.432MHz
2.304 MB/SEC
2850'
2843
2844
2845
2846
2847
2848
2849
IQ
DEMUX
DEMUX
SELECT
DC
OFFSET
ADJUST
DS
GAIN
OFFSET
DS
MIX
DECIMATOR
SCALING
15-BIT
FFT
REAL
IMAGINARY
N
Q
I
N+
N++
N+++
25
15
1.152MB/SEC
18.432MHz
18.432MHz
18.432MHz
2847'
2848'
288KHz

FIG. 94

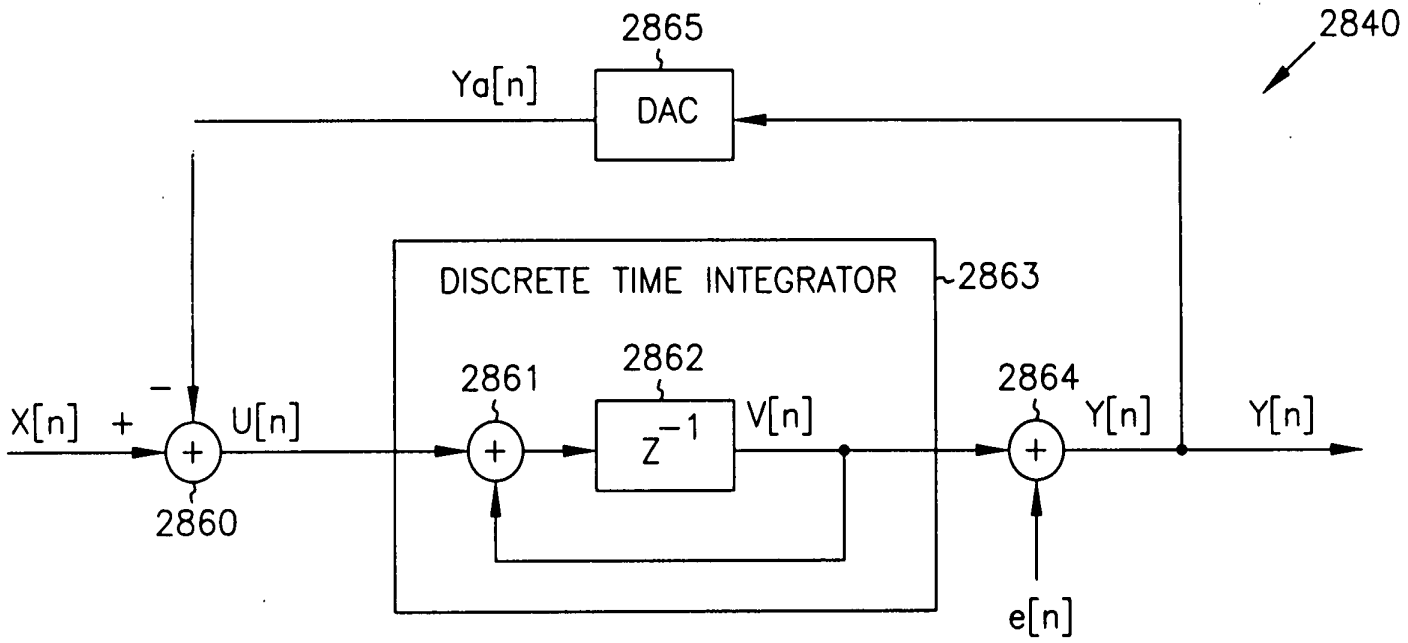

2865
2840
Ya[n]
DAC
DISCRETE TIME INTEGRATOR
2863
2861
2862
2864
X[n]
+
−
U[n]
V[n]
Y[n]
Y[n]
2860
e[n]

FIG. 95

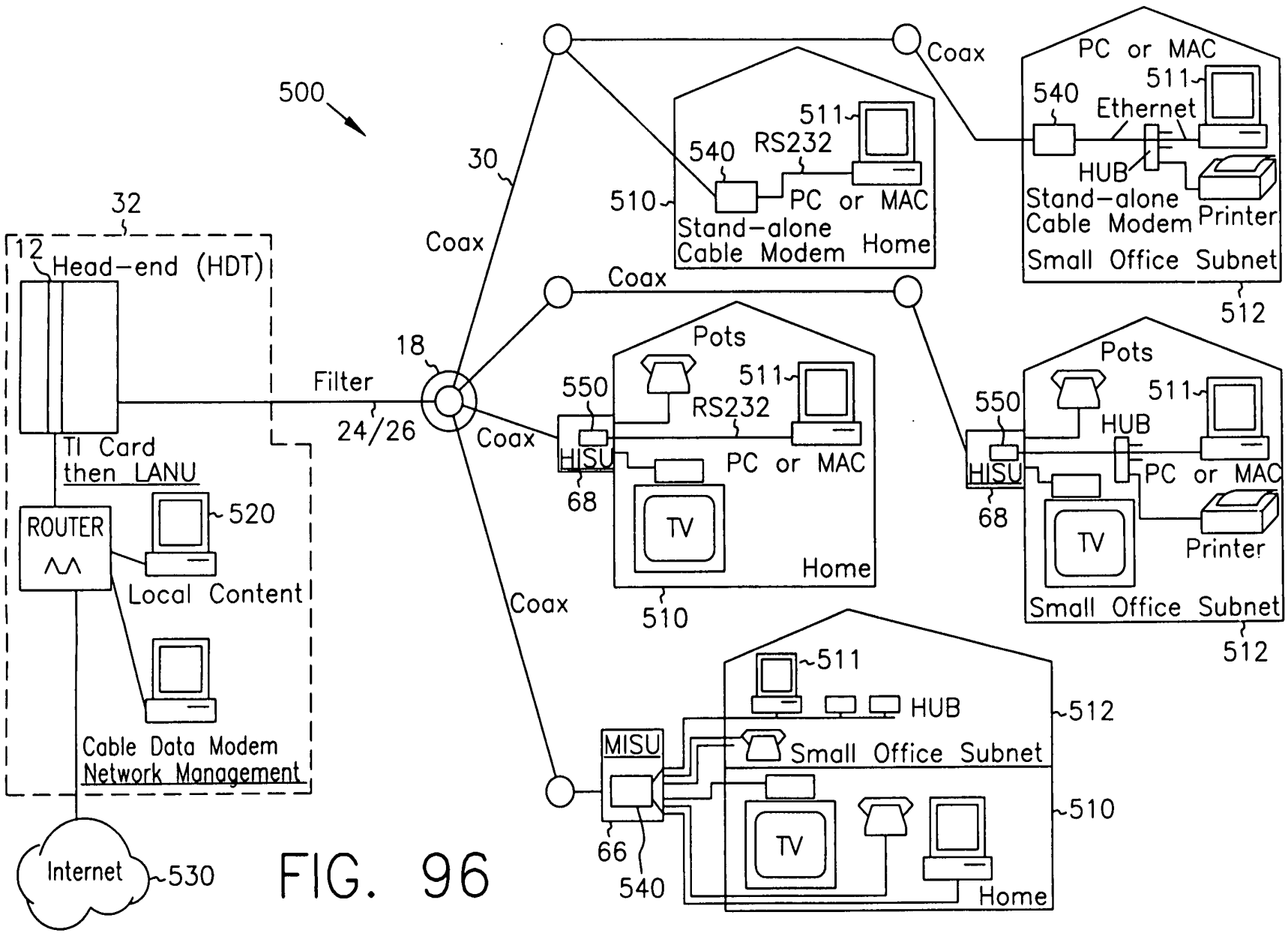

500
32
12
Head-end (HDT)
TI Card
then LANU
ROUTER
520
Local Content
Cable Data Modem
Network Management
Internet
530
Filter
24/26
18
30
Coax
Coax
Coax
Coax
Coax
510
Stand-alone
Cable Modem Home
540
RS232
511
PC or MAC
PC or MAC
511
540
Ethernet
HUB
Stand-alone
Cable Modem
Printer
Small Office Subnet
512
Pots
550
511
RS232
HISU
68
PC or MAC
TV
Home
510
Pots
550
511
HUB
HISU
68
PC or MAC
TV
Printer
Small Office Subnet
512
MISU
66
540
511
HUB
512
Small Office Subnet
510
TV
Home

FIG. 96

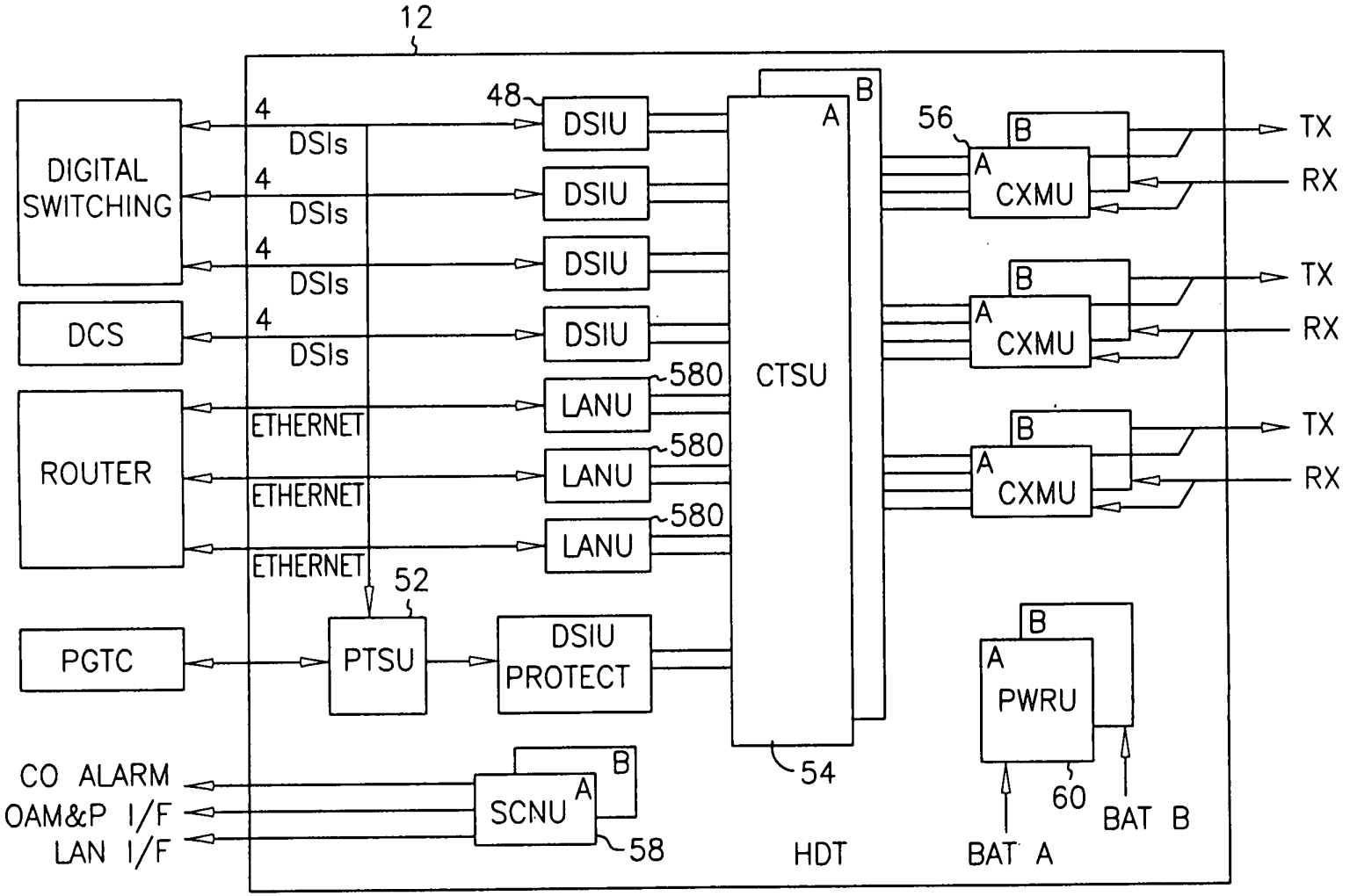

12
DIGITAL SWITCHING
DCS
ROUTER
PGTC
CO ALARM
OAM&P I/F
LAN I/F
4 DSIs
4 DSIs
4 DSIs
4 DSIs
ETHERNET
ETHERNET
ETHERNET
48
DSIU
DSIU
DSIU
DSIU
LANU
LANU
LANU
580
580
580
52
PTSU
DSIU PROTECT
SCNU
58
A
B
CTSU
54
HDT
56
CXMU
CXMU
CXMU
TX
RX
TX
RX
TX
RX
PWRU
60
BAT A
BAT B

FIG. 97

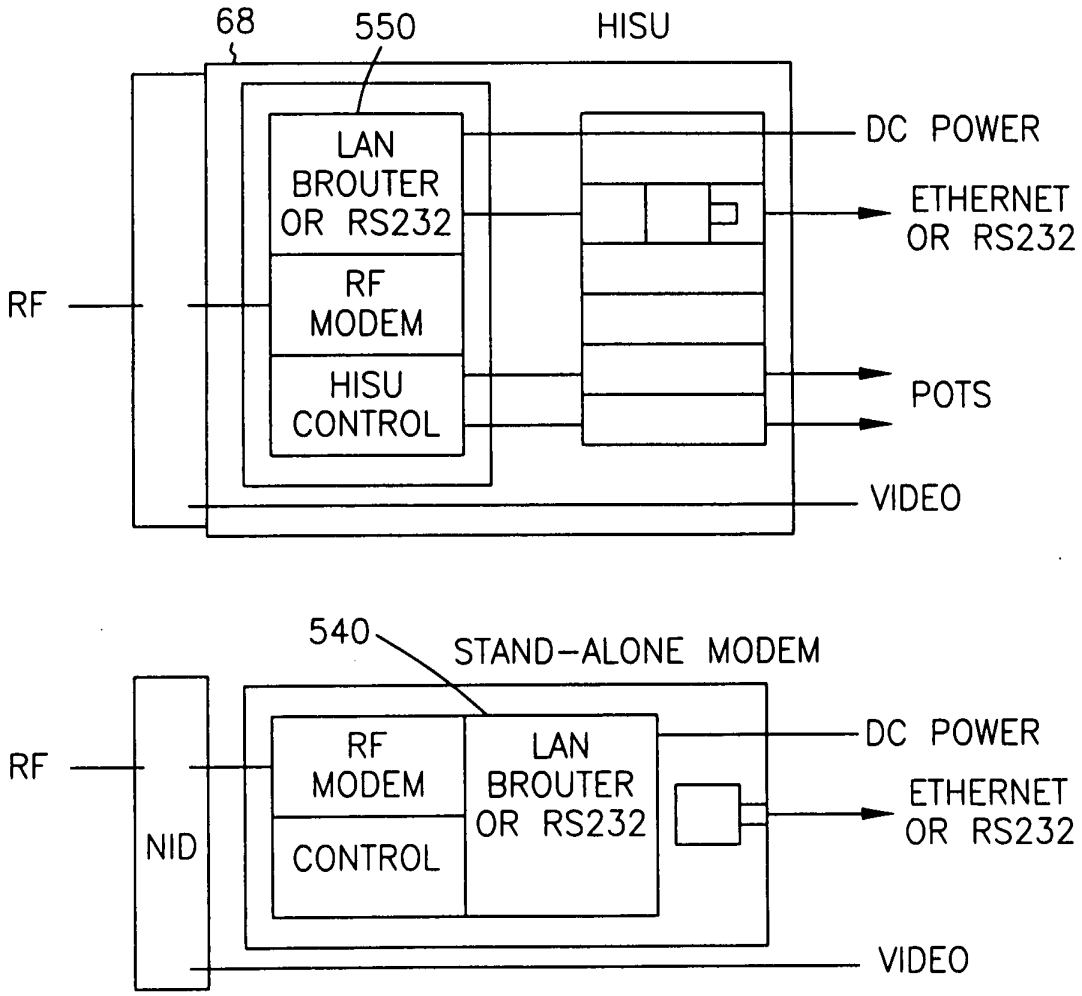

68
550
HISU
LAN
BROUTER
OR RS232
RF
MODEM
HISU
CONTROL
RF
DC POWER
ETHERNET
OR RS232
POTS
VIDEO
540
STAND-ALONE MODEM
RF
NID
RF
MODEM
CONTROL
LAN
BROUTER
OR RS232
DC POWER
ETHERNET
OR RS232
VIDEO

FIG. 98

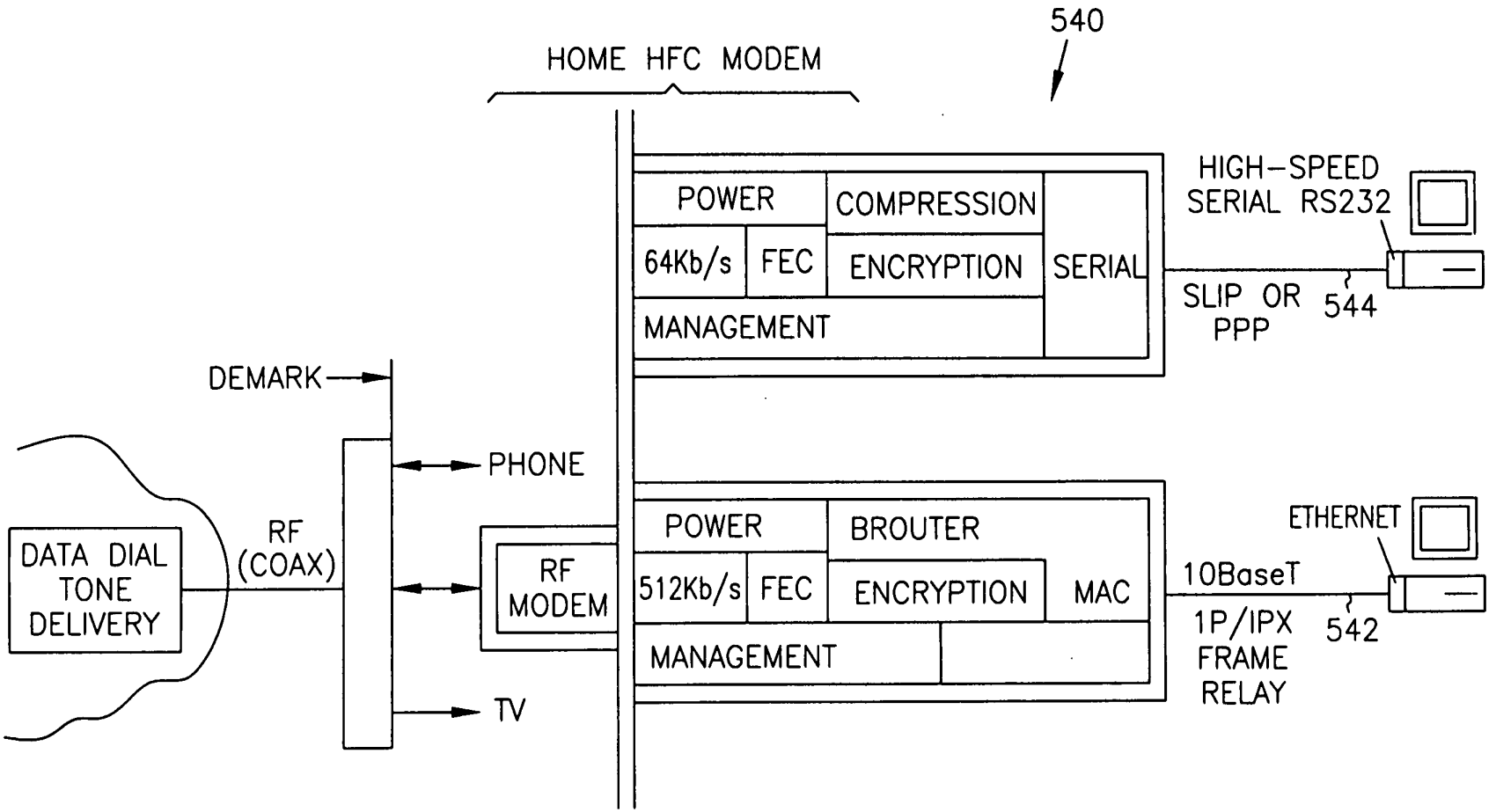

540
HOME HFC MODEM
POWER
COMPRESSION
64Kb/s
FEC
ENCRYPTION
SERIAL
MANAGEMENT
HIGH-SPEED SERIAL RS232
SLIP OR PPP
544
DEMARK
PHONE
DATA DIAL TONE DELIVERY
RF (COAX)
RF MODEM
POWER
BROUTER
512Kb/s
FEC
ENCRYPTION
MAC
MANAGEMENT
ETHERNET
10BaseT
1P/IPX FRAME RELAY
542
TV

FIG. 99

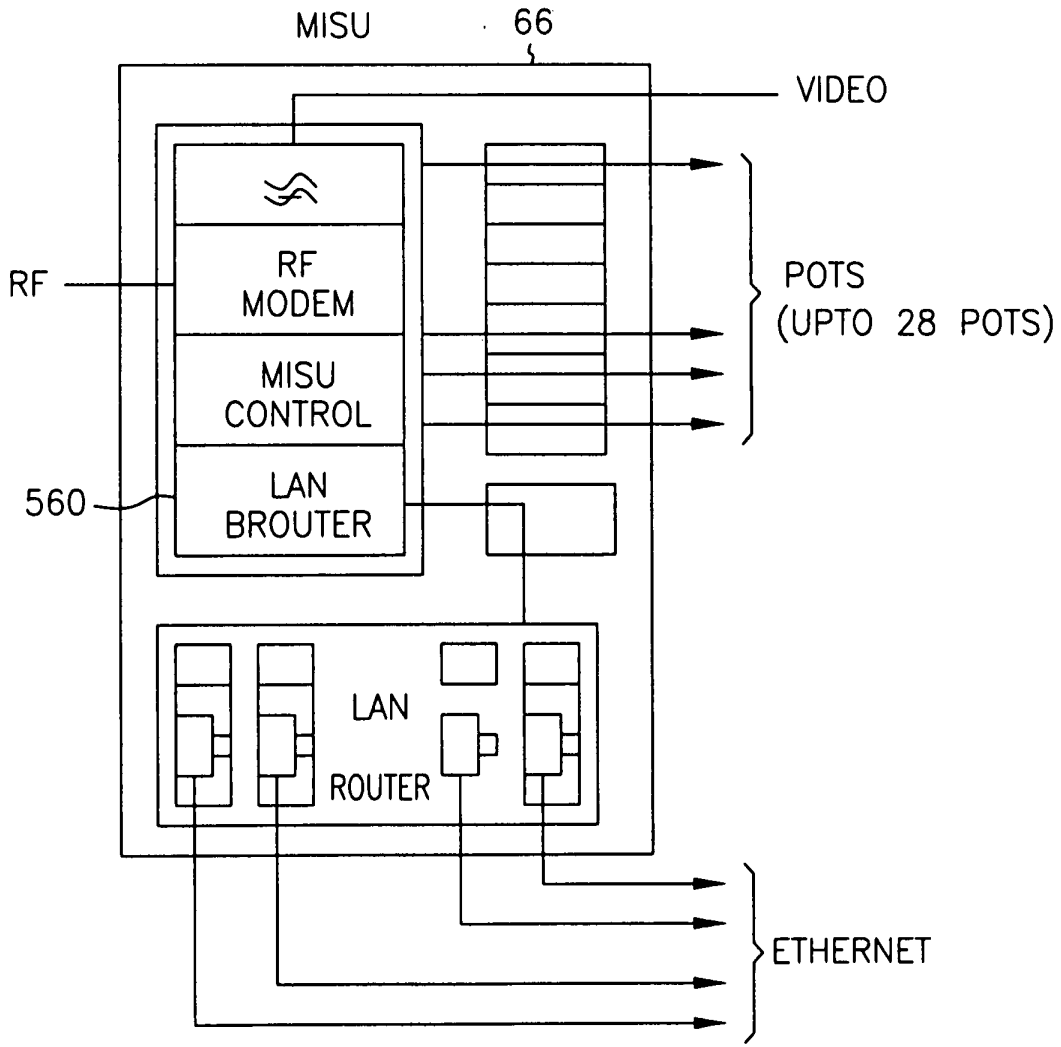

MISU
66
VIDEO
RF
RF MODEM
MISU CONTROL
LAN BROUTER
560
POTS
(UPTO 28 POTS)
LAN
ROUTER
ETHERNET

FIG. 100

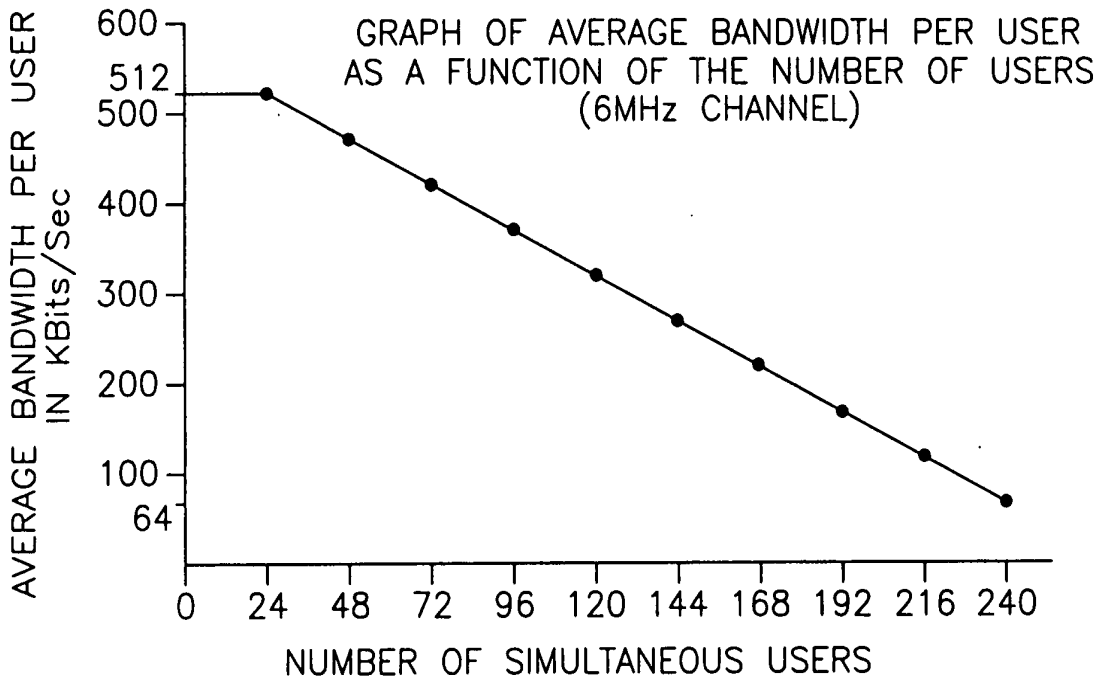

GRAPH OF AVERAGE BANDWIDTH PER USER
AS A FUNCTION OF THE NUMBER OF USERS
(6MHz CHANNEL)
AVERAGE BANDWIDTH PER USER
IN KBits/Sec
600
512
500
400
300
200
100
64
0
24
48
72
96
120
144
168
192
216
240
NUMBER OF SIMULTANEOUS USERS

FIG. 101

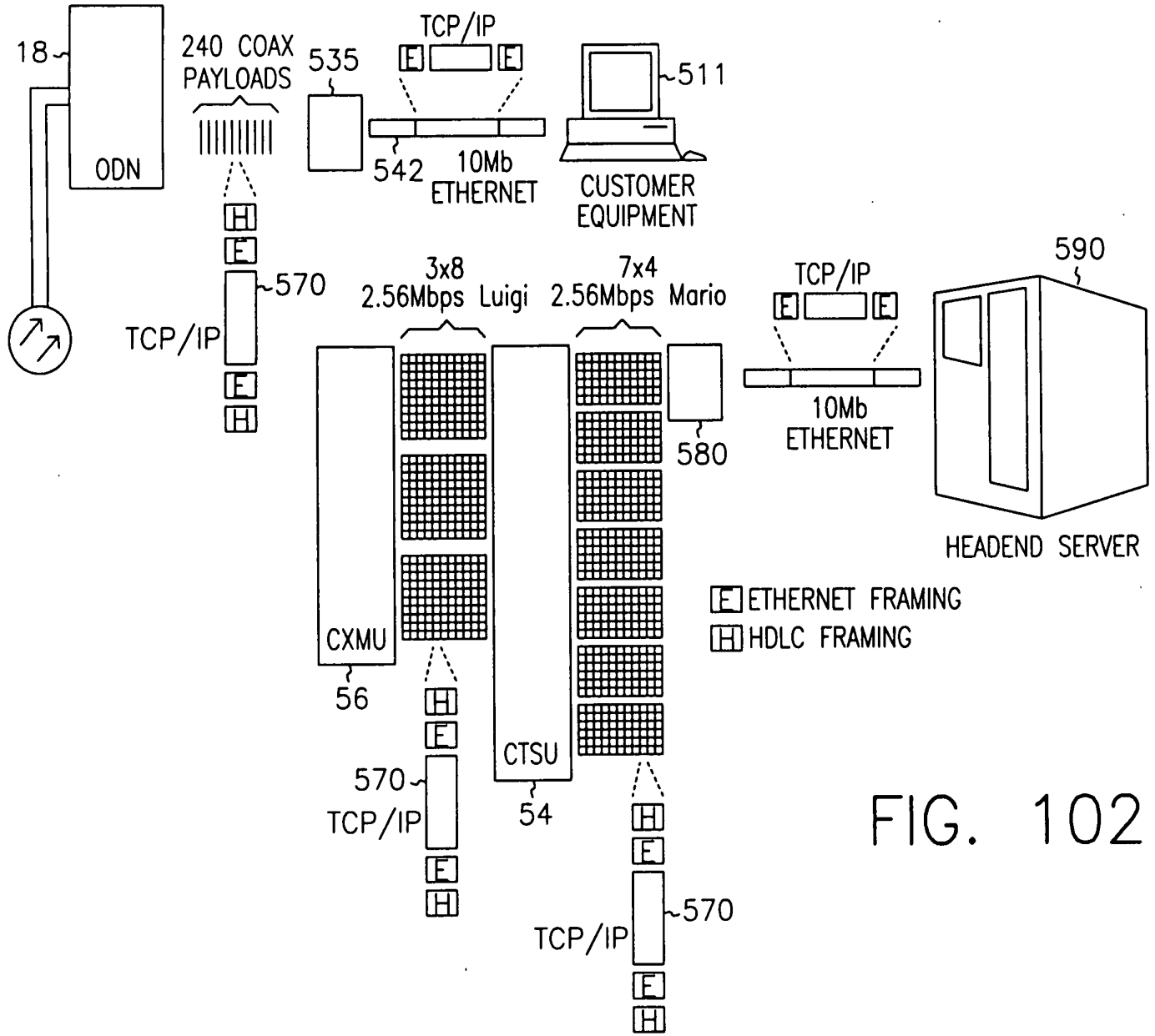

18
ODN
240 COAX
PAYLOADS
535
TCP/IP
542
10Mb
ETHERNET
511
CUSTOMER
EQUIPMENT
570
TCP/IP
3x8
2.56Mbps Luigi
7x4
2.56Mbps Mario
590
TCP/IP
10Mb
ETHERNET
580
HEADEND SERVER
CXMU
56
CTSU
54
570
TCP/IP
570
TCP/IP
E ETHERNET FRAMING
H HDLC FRAMING

FIG. 102

T06020"h2ET0660

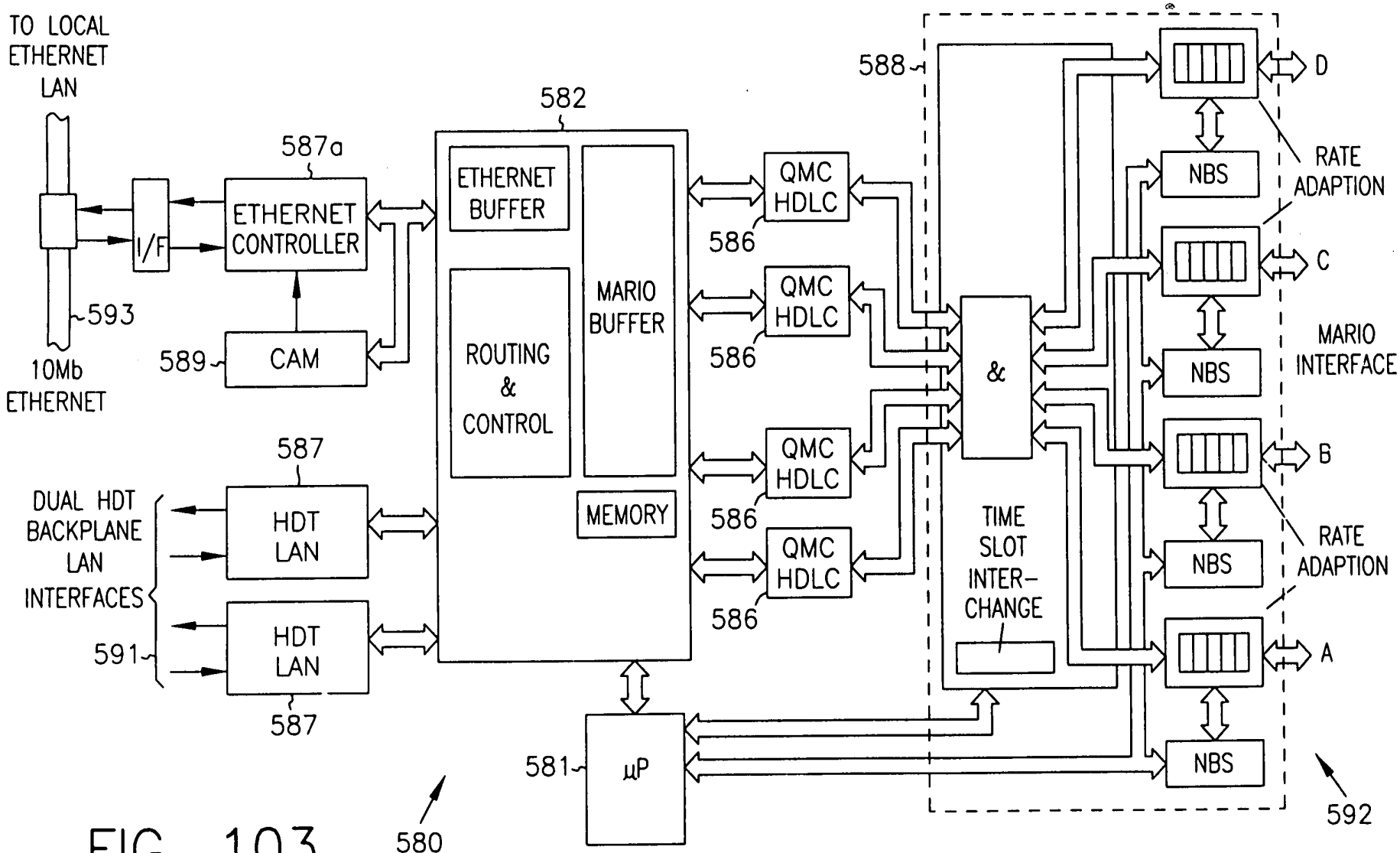


FIG. 103

T06020"t2ET0660

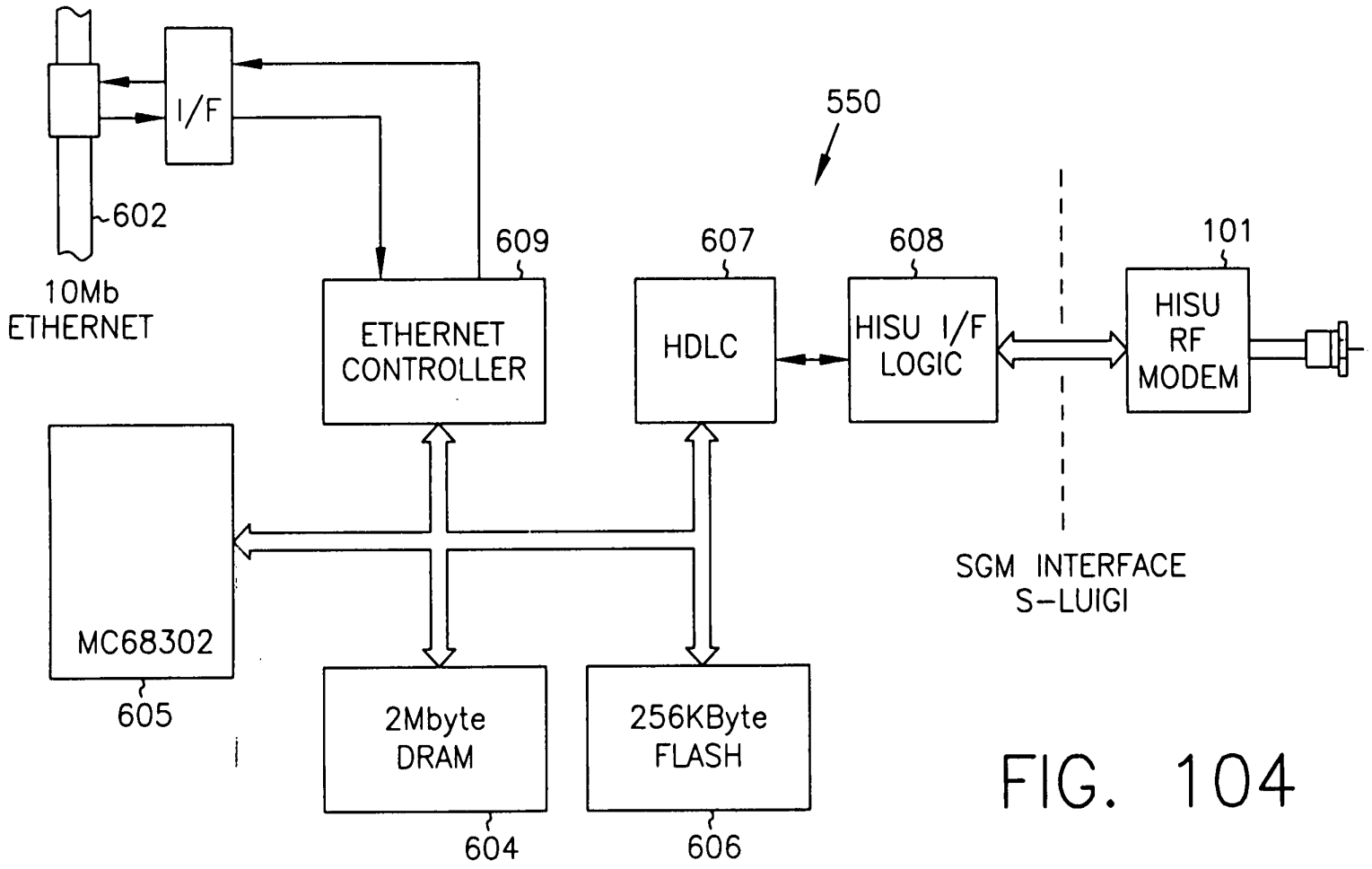


FIG. 104

T06020 "4ET0660

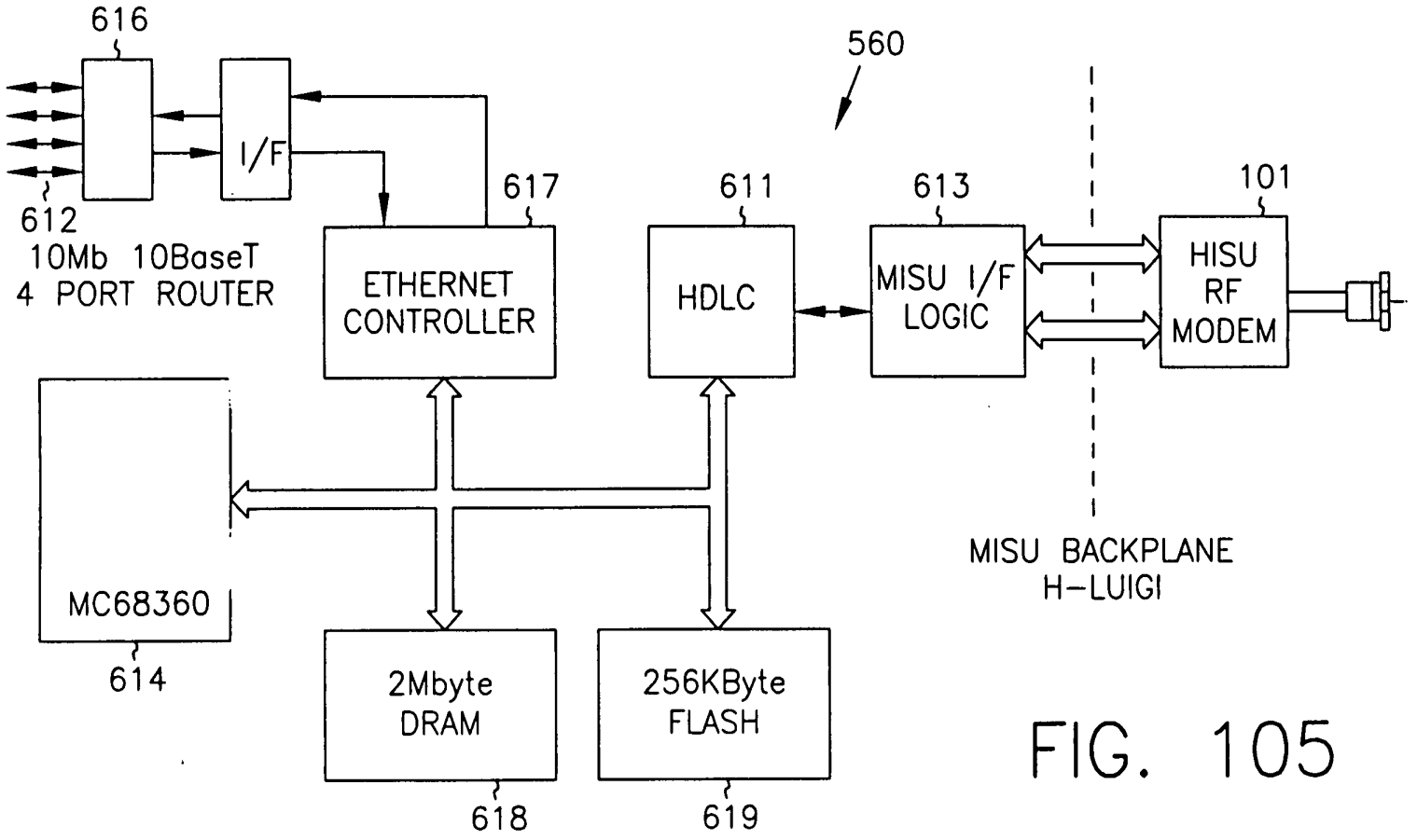


FIG. 105

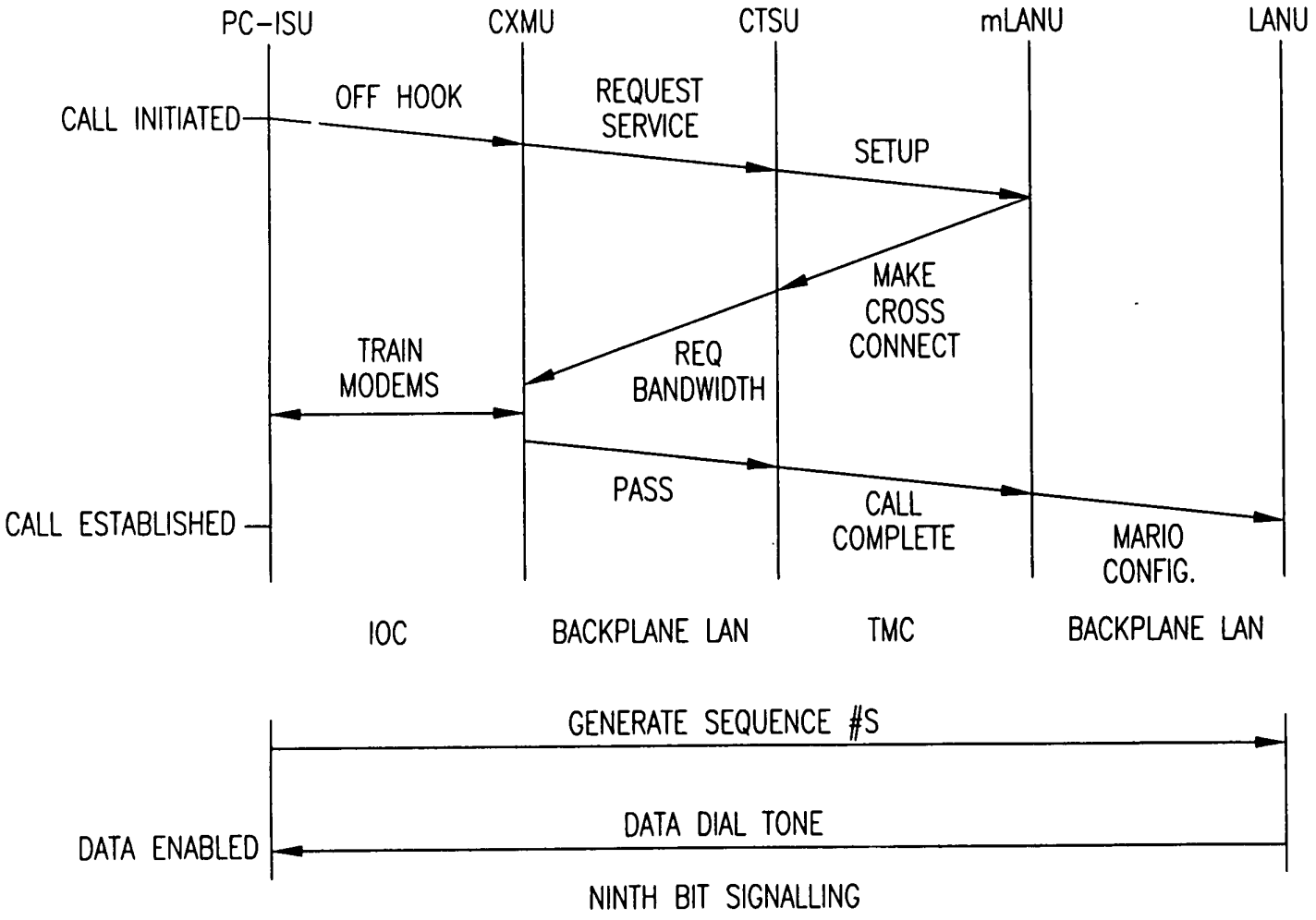

PC-ISU
CXMU
CTSU
mLANU
LANU
CALL INITIATED
OFF HOOK
REQUEST SERVICE
SETUP
MAKE CROSS CONNECT
TRAIN MODEMS
REQ BANDWIDTH
PASS
CALL COMPLETE
MARIO CONFIG.
CALL ESTABLISHED
IOC
BACKPLANE LAN
TMC
BACKPLANE LAN
GENERATE SEQUENCE #S
DATA DIAL TONE
DATA ENABLED
NINTH BIT SIGNALLING

FIG. 106

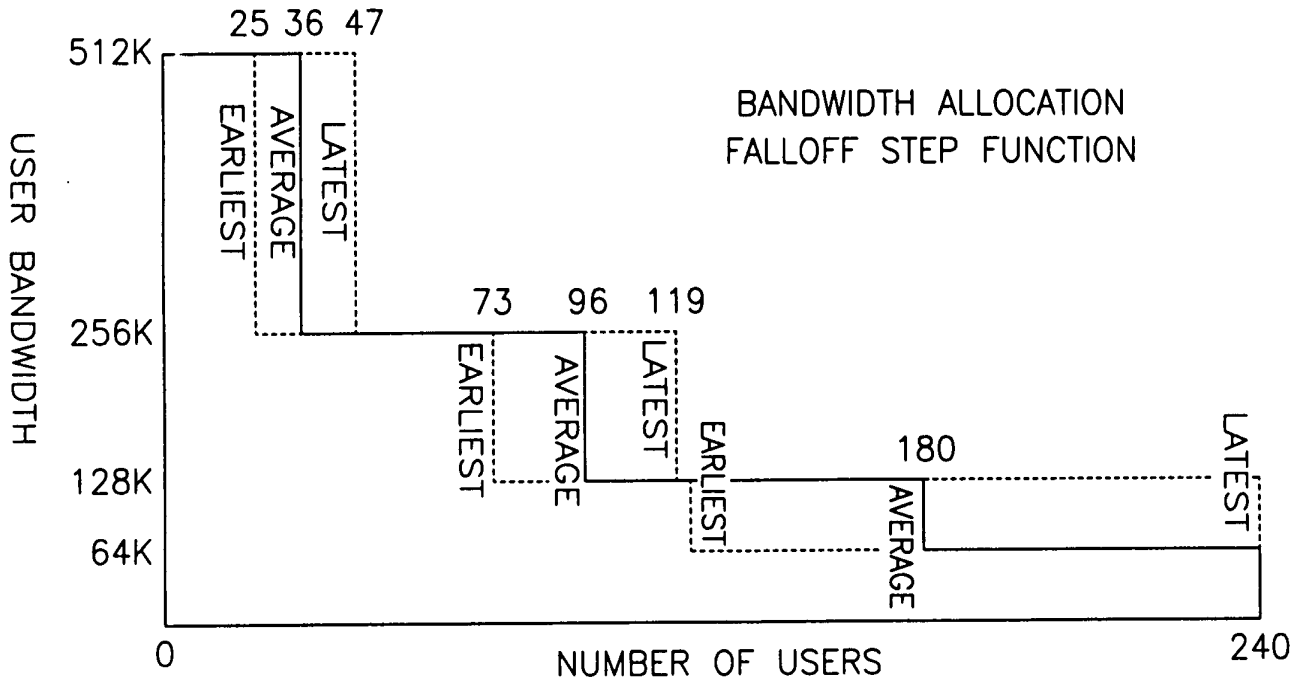
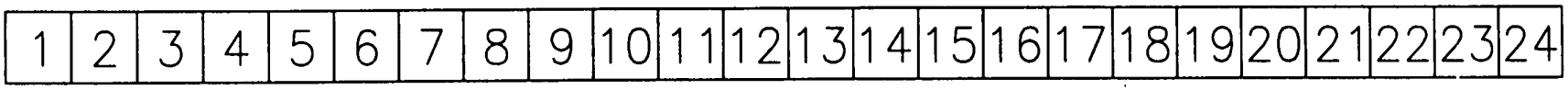
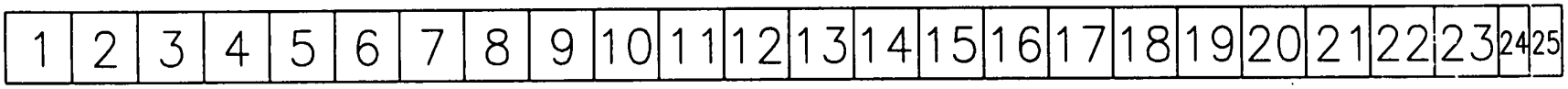

25 36 47
512K
BANDWIDTH ALLOCATION
FALLOFF STEP FUNCTION
EARLIEST
AVERAGE
LATEST
73 96 119
256K
EARLIEST
AVERAGE
LATEST
180
128K
EARLIEST
AVERAGE
LATEST
64K
USER BANDWIDTH
0
NUMBER OF USERS
240

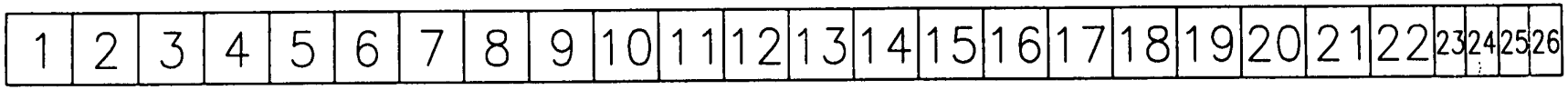
FIG. 107



THE RF SPECTRUM OF 24 USERS WITH 512Kbs



ADDING THE 25th USER



ADDING THE 26th USER, ETC

FIG. 108

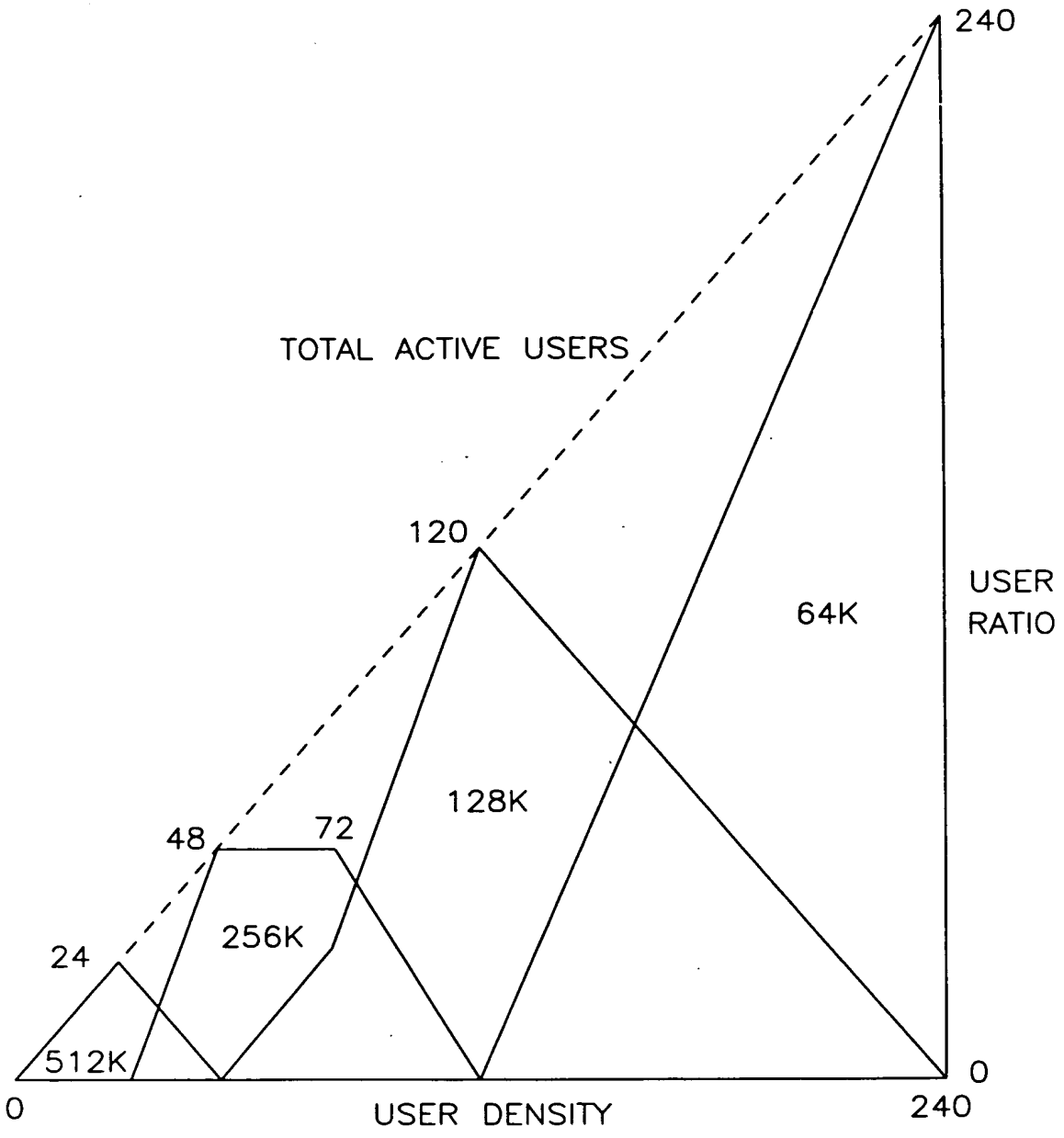

240
TOTAL ACTIVE USERS
120
USER
RATIO
64K
128K
48
72
256K
24
512K
0
0
USER DENSITY
240

FIG. 109

T06020"h2ET0660

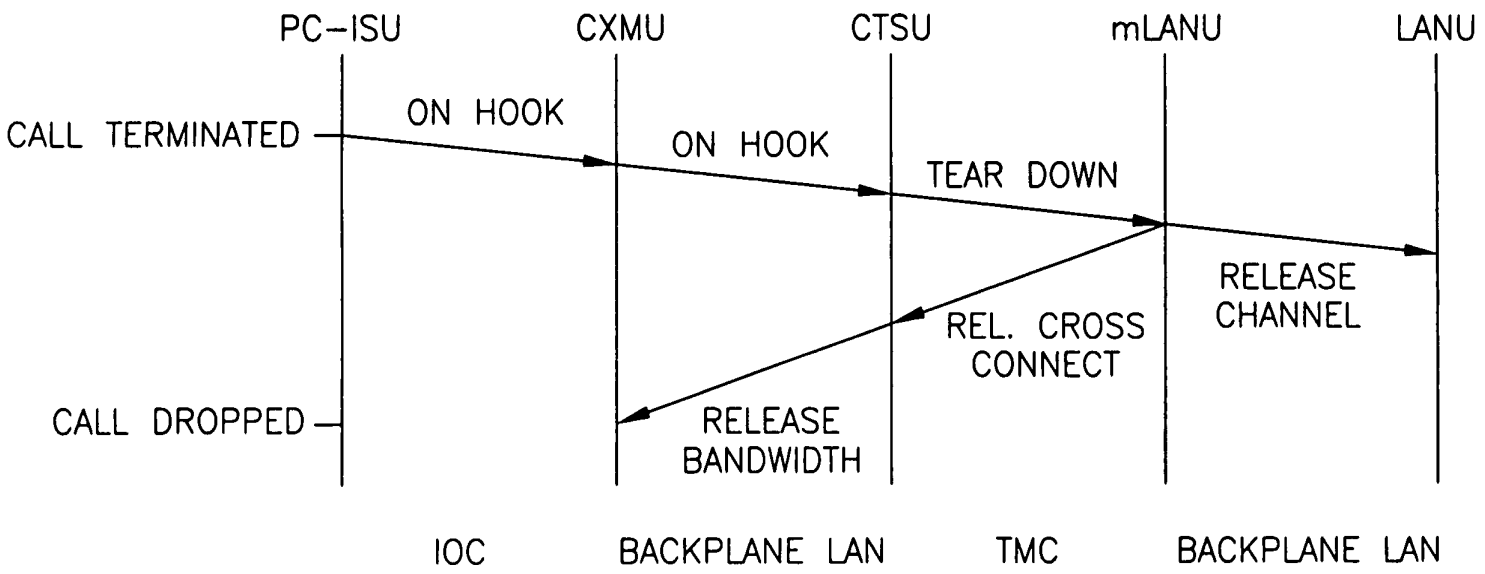


FIG. 110

T06020 "WET0660

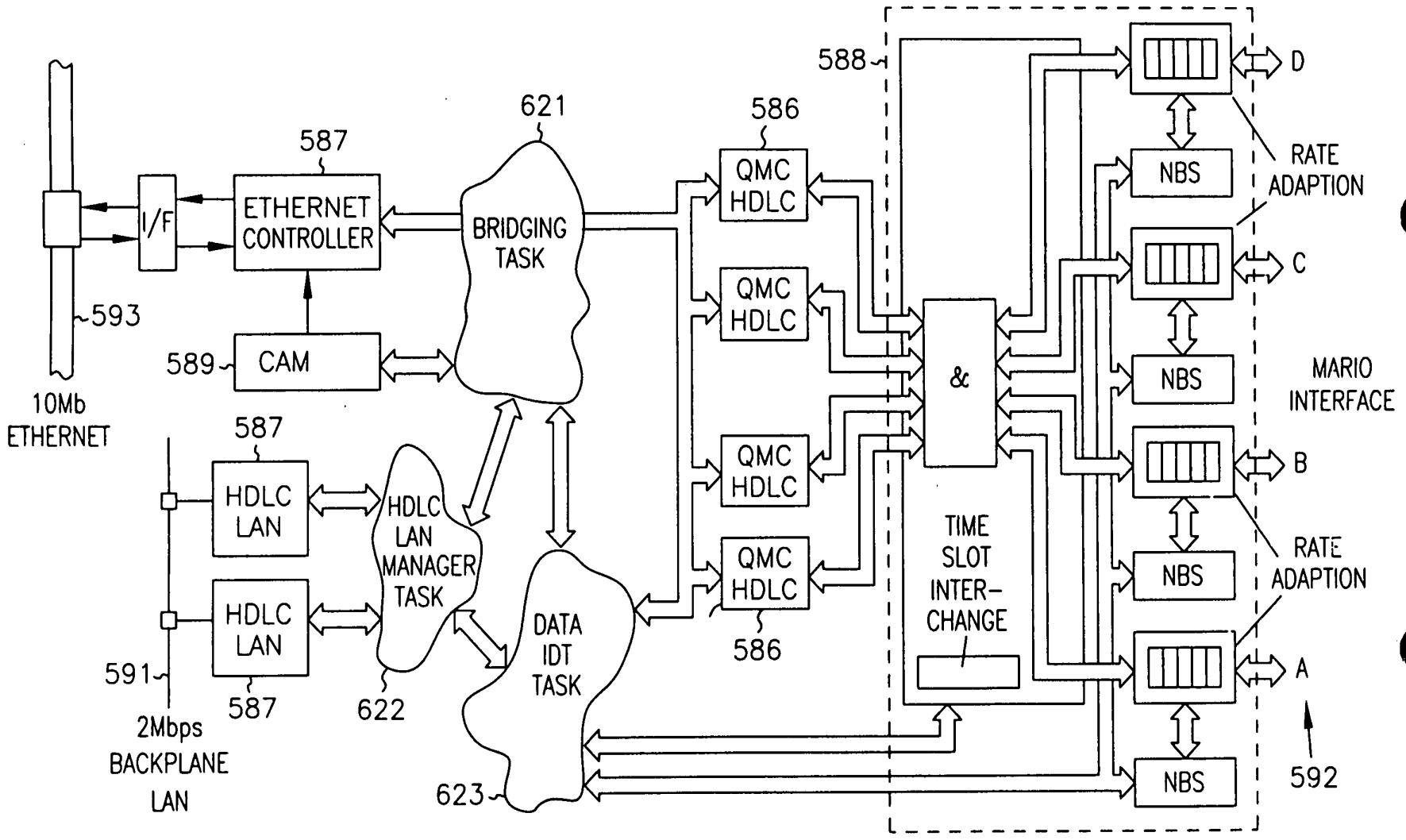


FIG. 111

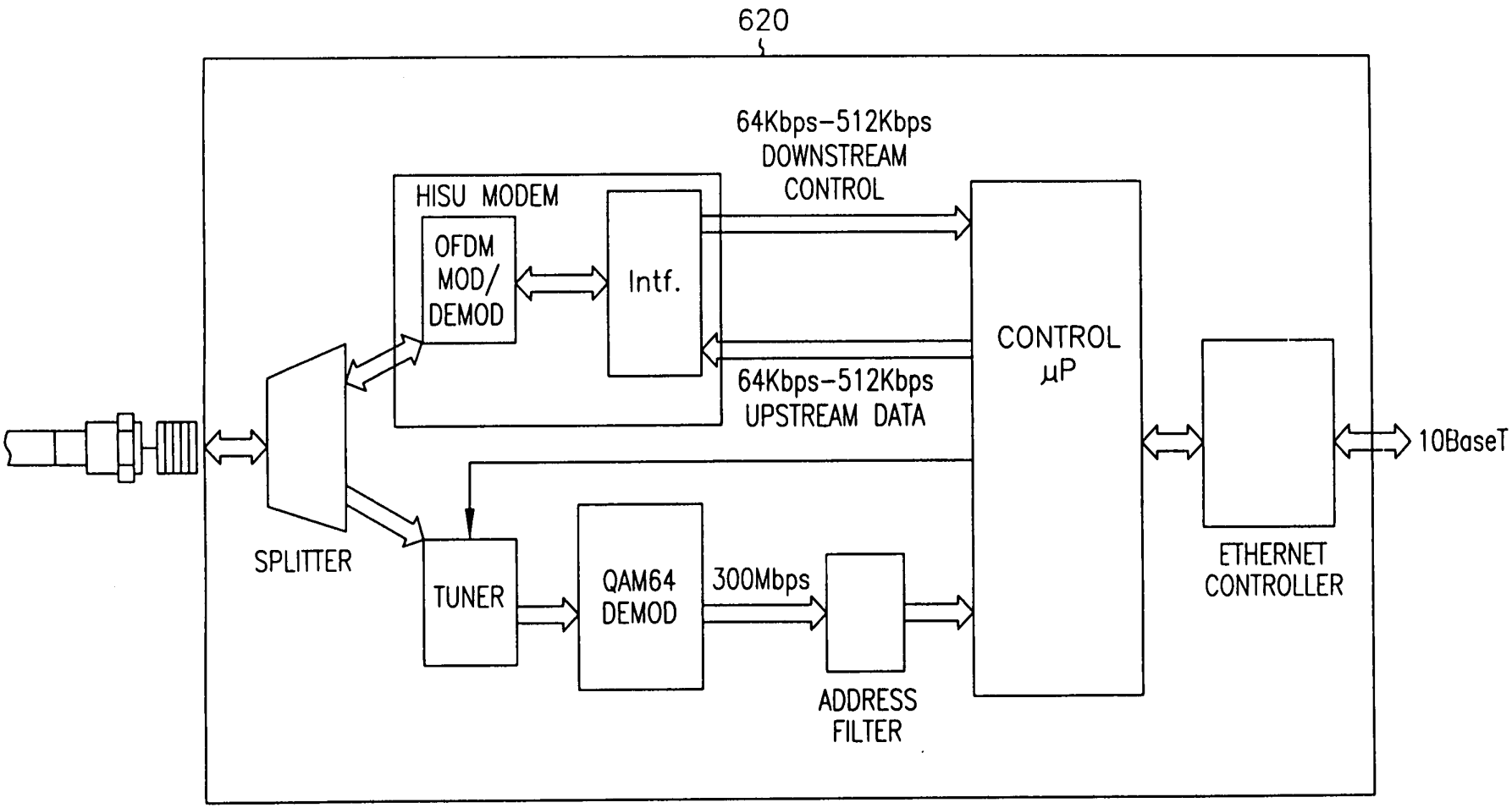

620
64Kbps-512Kbps
DOWNSTREAM
CONTROL
HISU MODEM
OFDM
MOD/
DEMOD
Intf.
CONTROL
µP
64Kbps-512Kbps
UPSTREAM DATA
10BaseT
SPLITTER
TUNER
QAM64
DEMOD
300Mbps
ETHERNET
CONTROLLER
ADDRESS
FILTER

FIG. 112

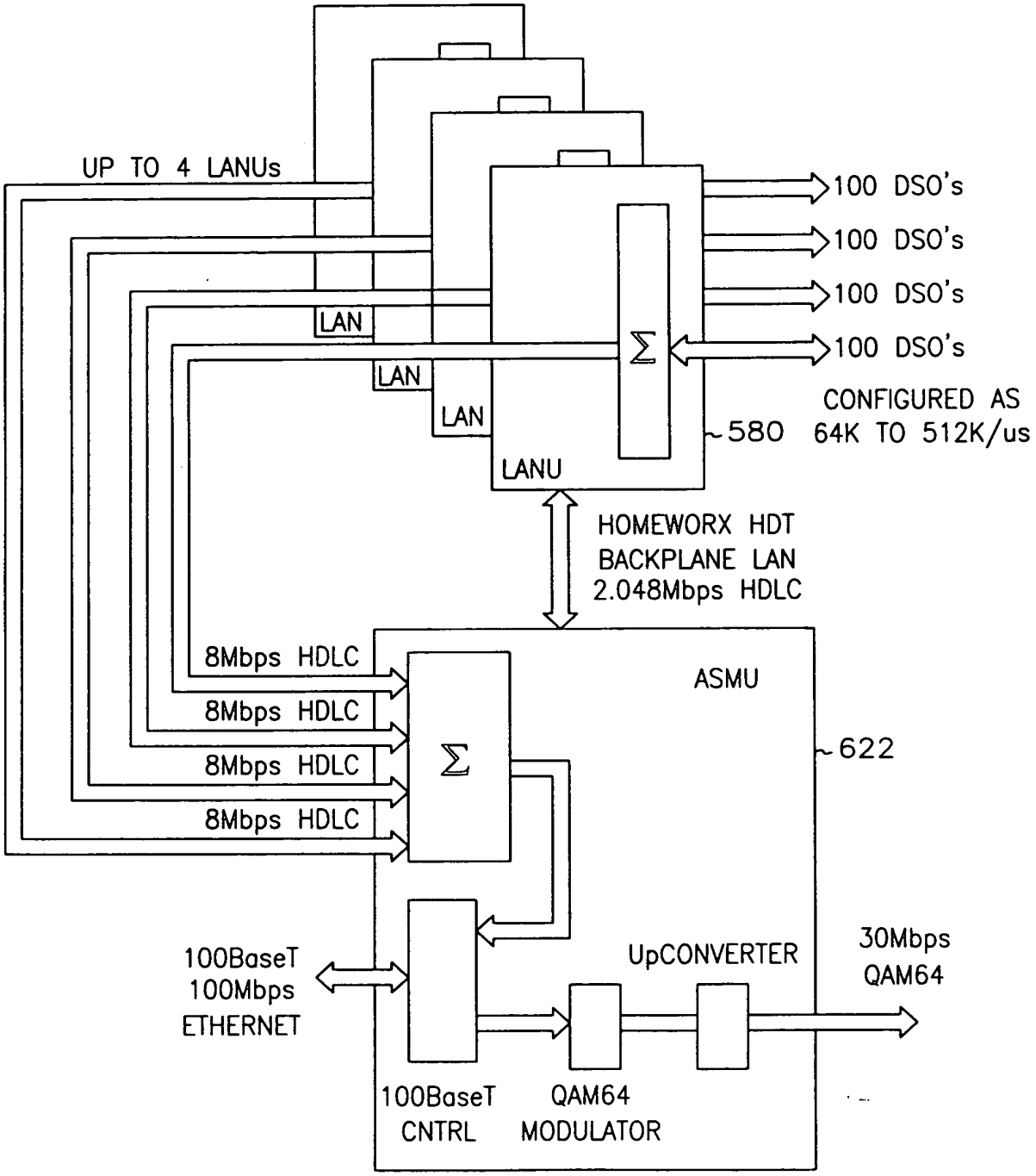

UP TO 4 LANUs
100 DSO's
100 DSO's
100 DSO's
100 DSO's
LAN
LAN
LAN
LANU
Σ
CONFIGURED AS
64K TO 512K/us
~580
HOMEWORX HDT
BACKPLANE LAN
2.048Mbps HDLC
8Mbps HDLC
8Mbps HDLC
8Mbps HDLC
8Mbps HDLC
Σ
ASMU
~622
100BaseT
100Mbps
ETHERNET
UpCONVERTER
30Mbps
QAM64
100BaseT
CNTRL
QAM64
MODULATOR

FIG. 113

T06020 "hZETO660

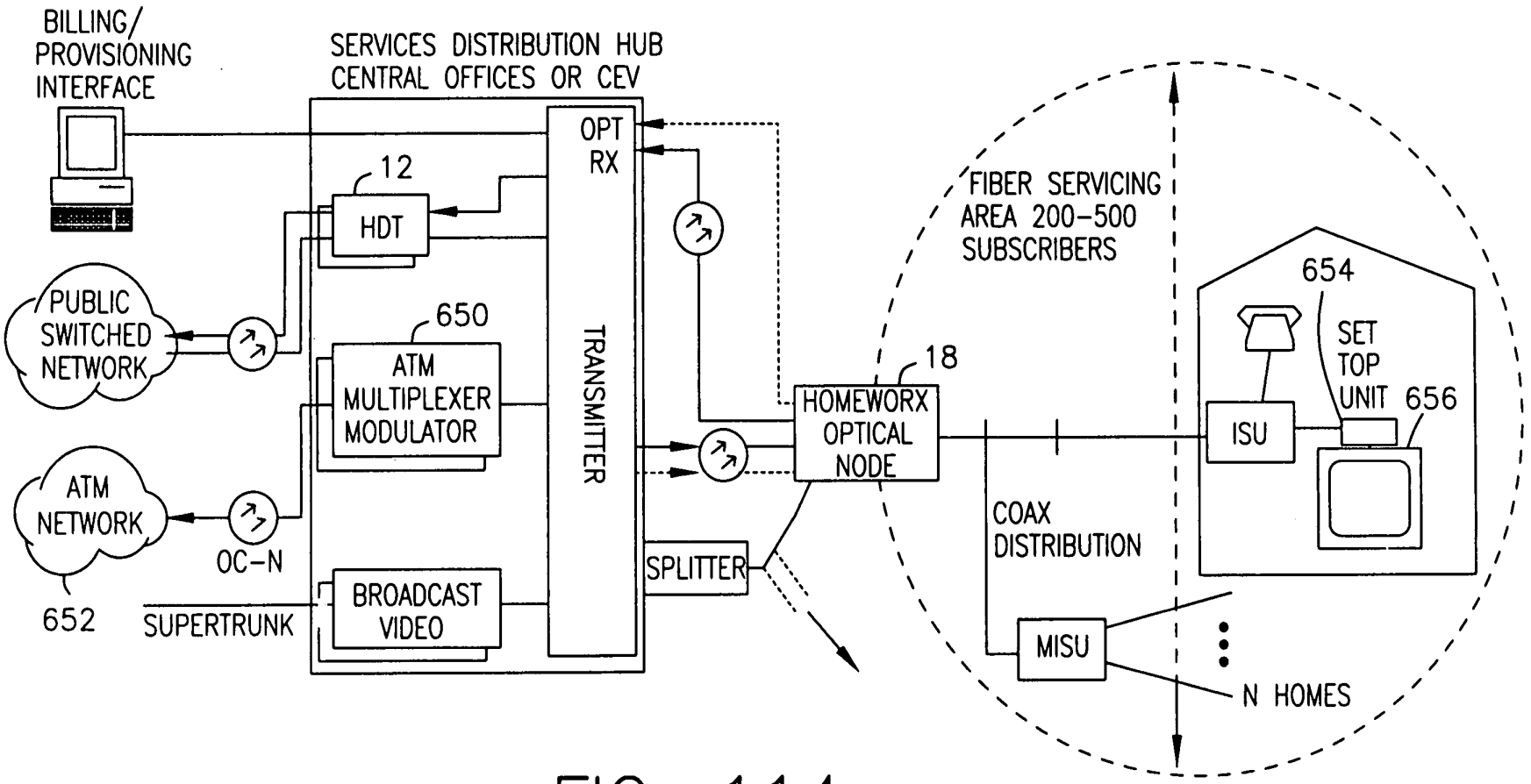


FIG. 114

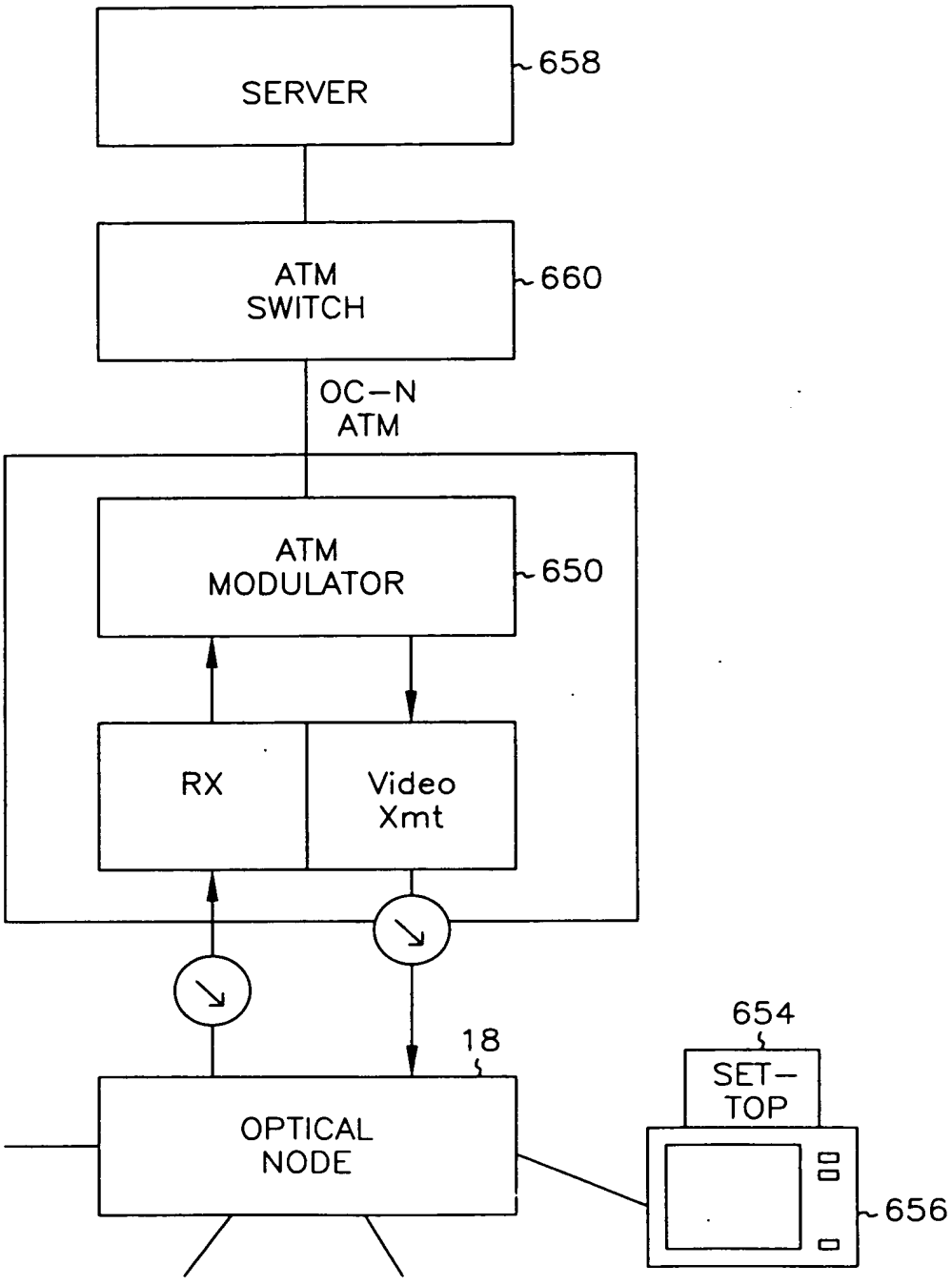

SERVER
658
ATM
SWITCH
660
OC–N
ATM
ATM
MODULATOR
650
RX
Video
Xmt
18
654
SET–
TOP
OPTICAL
NODE
656

FIG. 115

T06020"h2ET0660

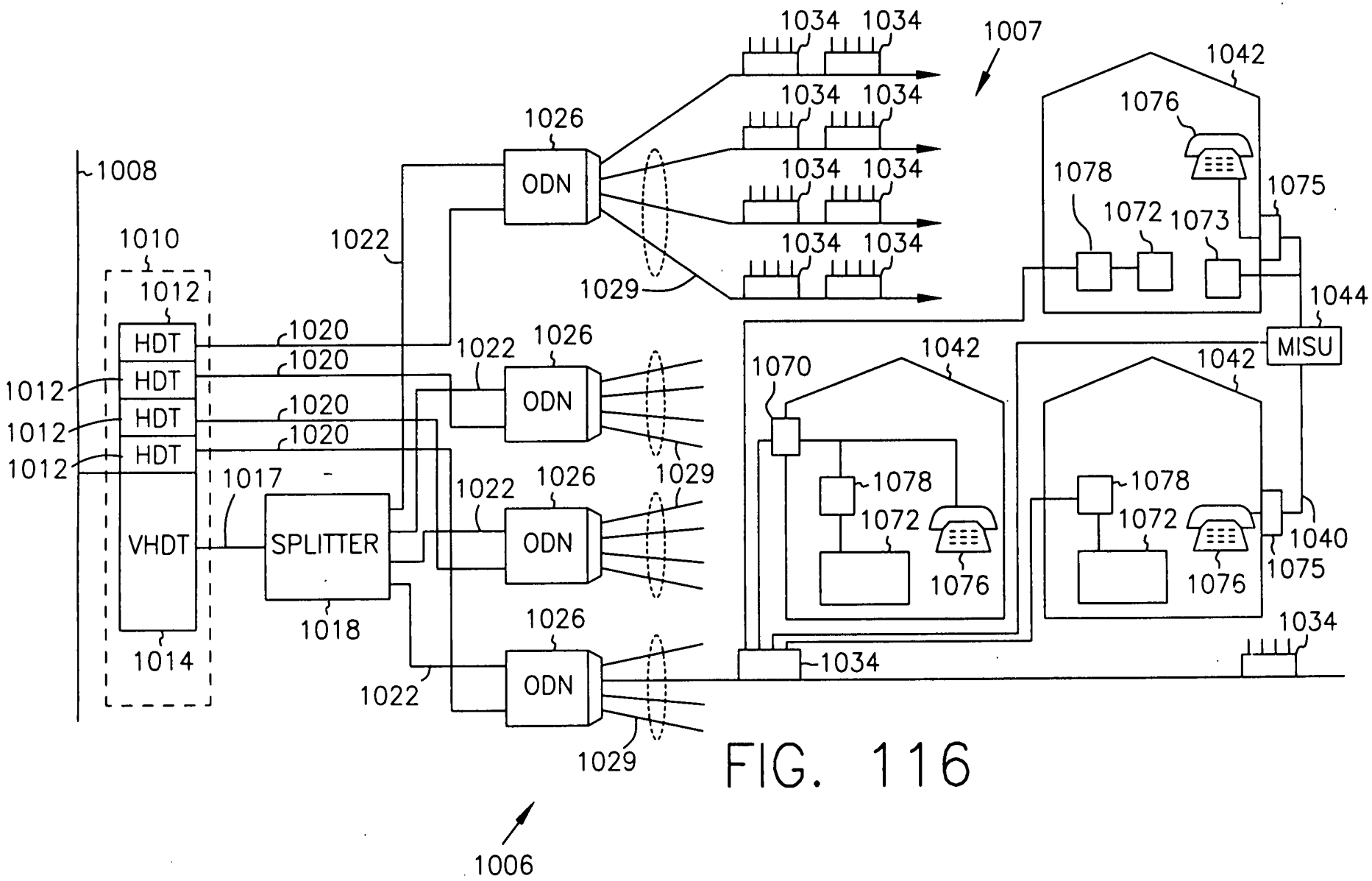


FIG. 116

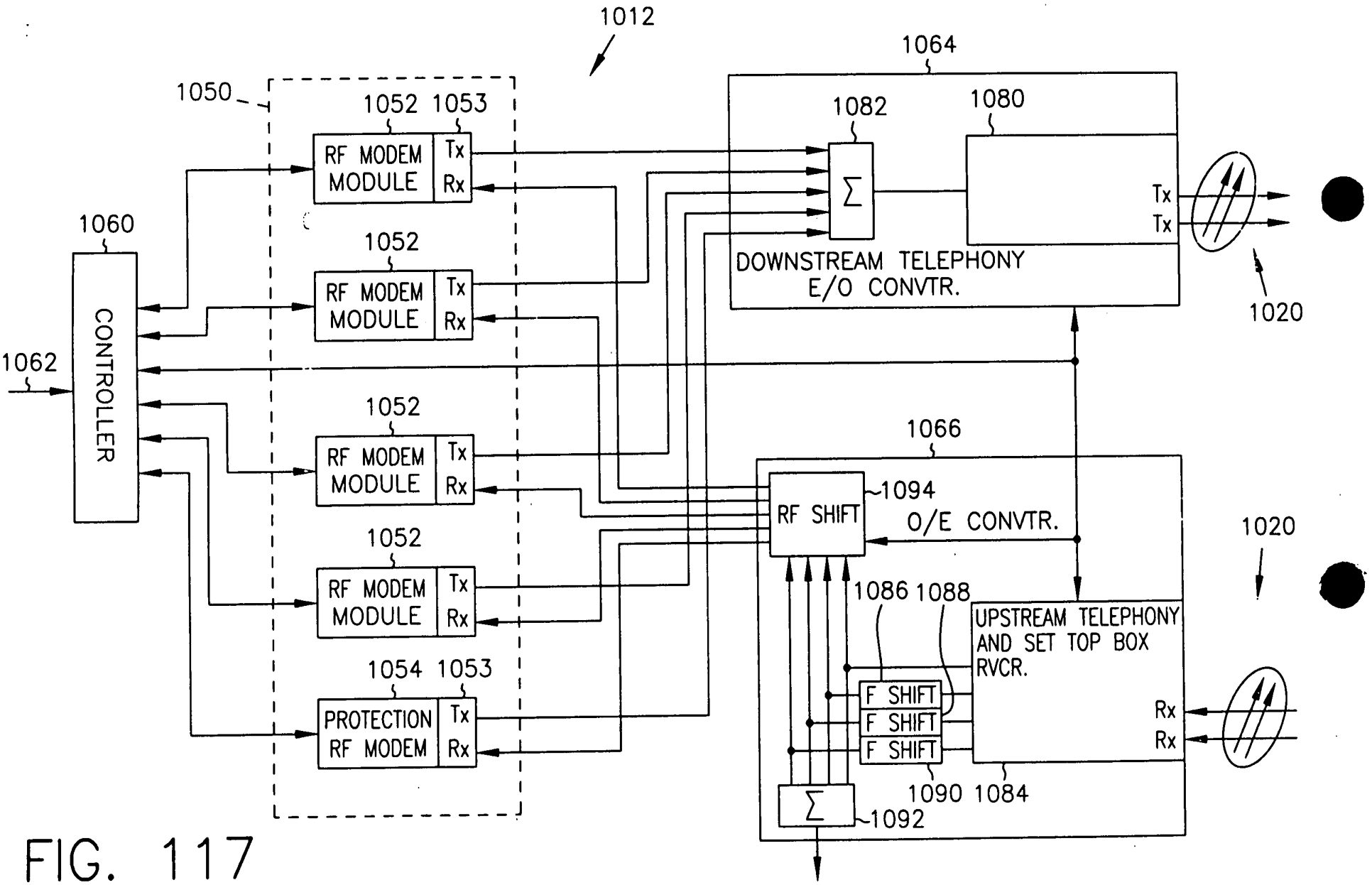

1012
1064
1050
1052 1053
1082
1080
RF MODEM MODULE
Tx
Rx
Σ
Tx
Tx
DOWNSTREAM TELEPHONY E/O CONVTR.
1020
1060
1052
CONTROLLER
1062
1052
1066
1094
RF SHIFT
O/E CONVTR.
1020
1052
1086 1088
UPSTREAM TELEPHONY AND SET TOP BOX RVCR.
1054 1053
PROTECTION RF MODEM
F SHIFT
F SHIFT
F SHIFT
Rx
Rx
1090 1084
Σ
1092

FIG. 117

TD6020"+2ETD660

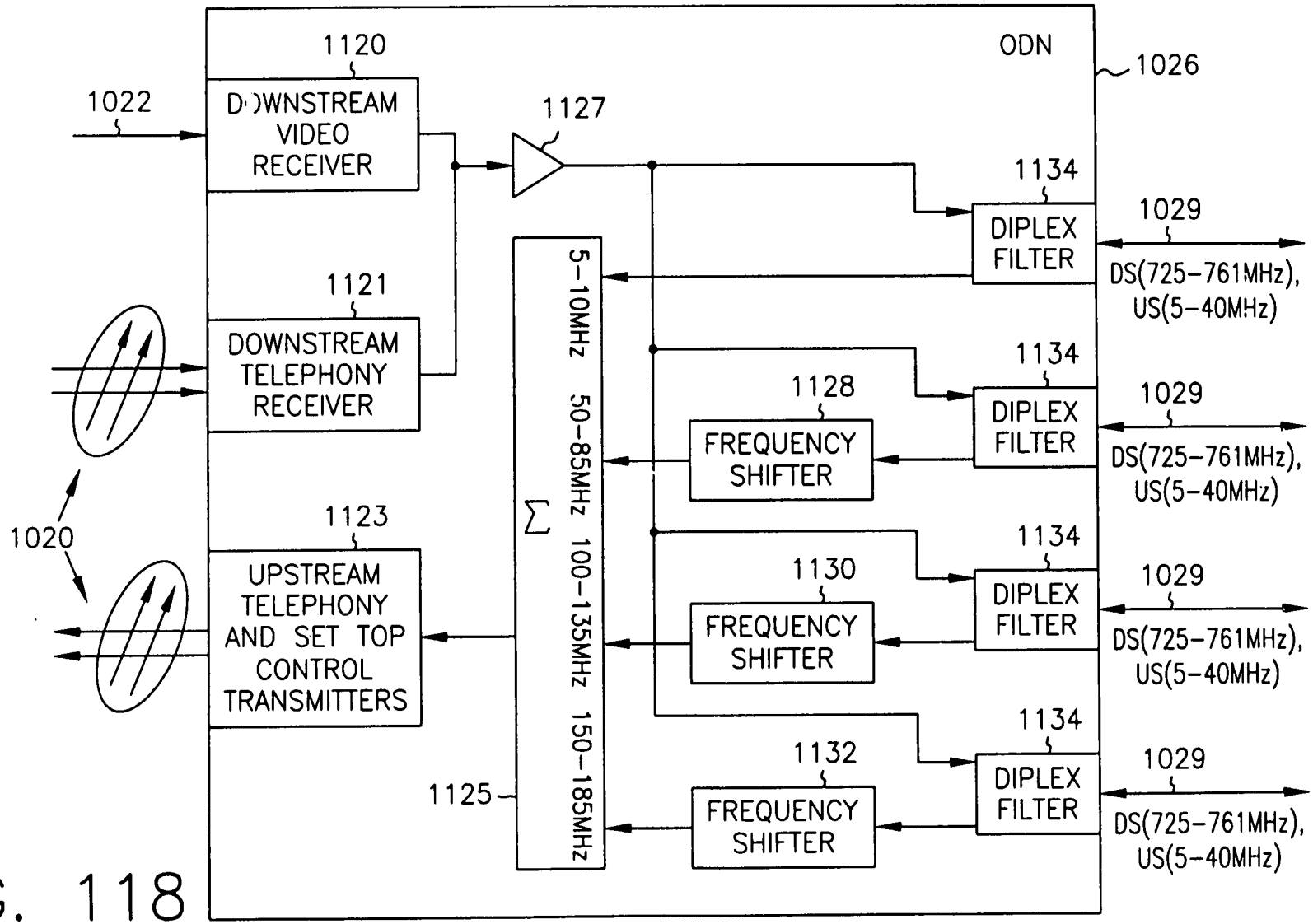


FIG. 118

T06020"tZET0660

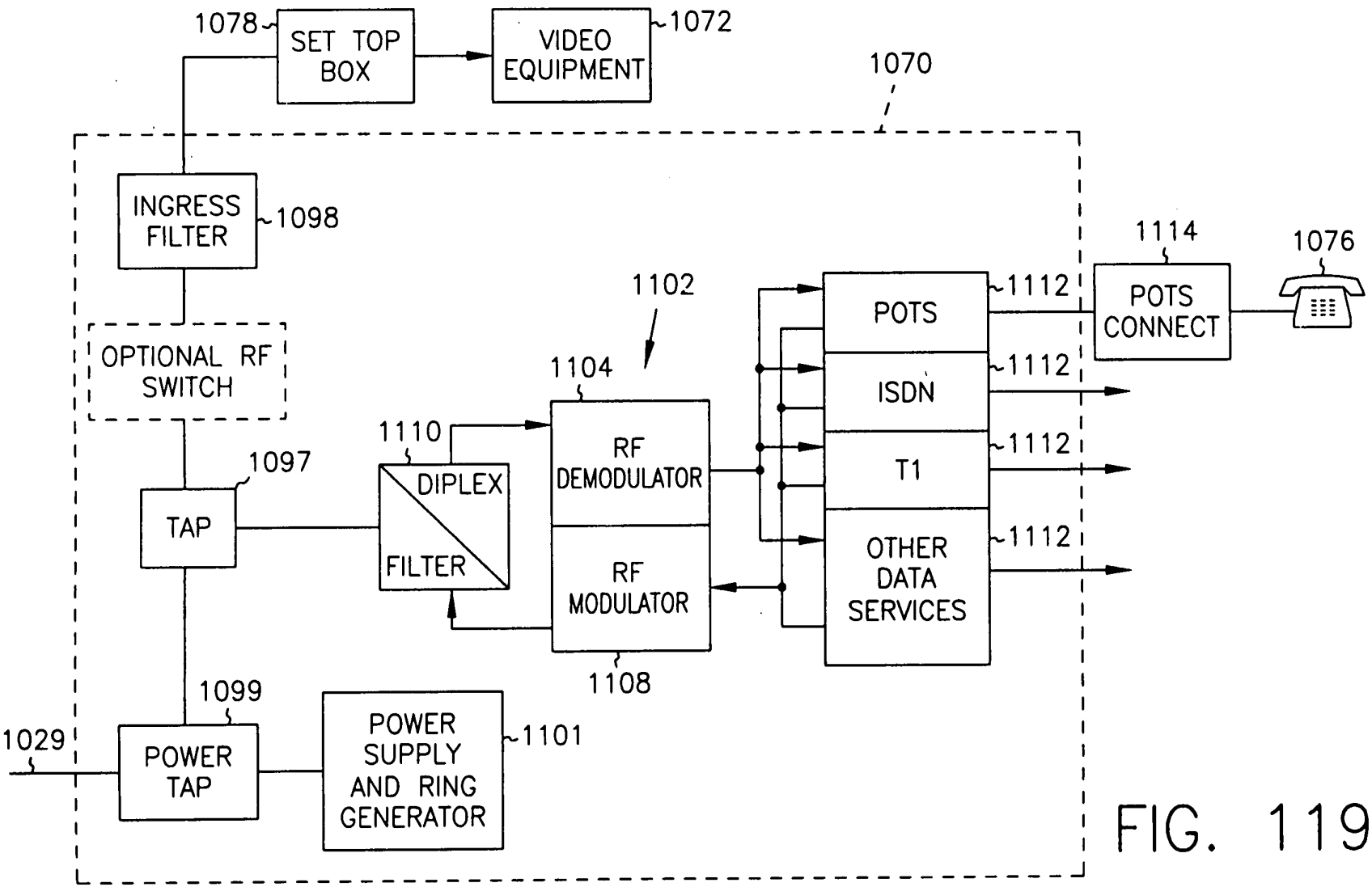


FIG. 119

T06020 "h2ET066D

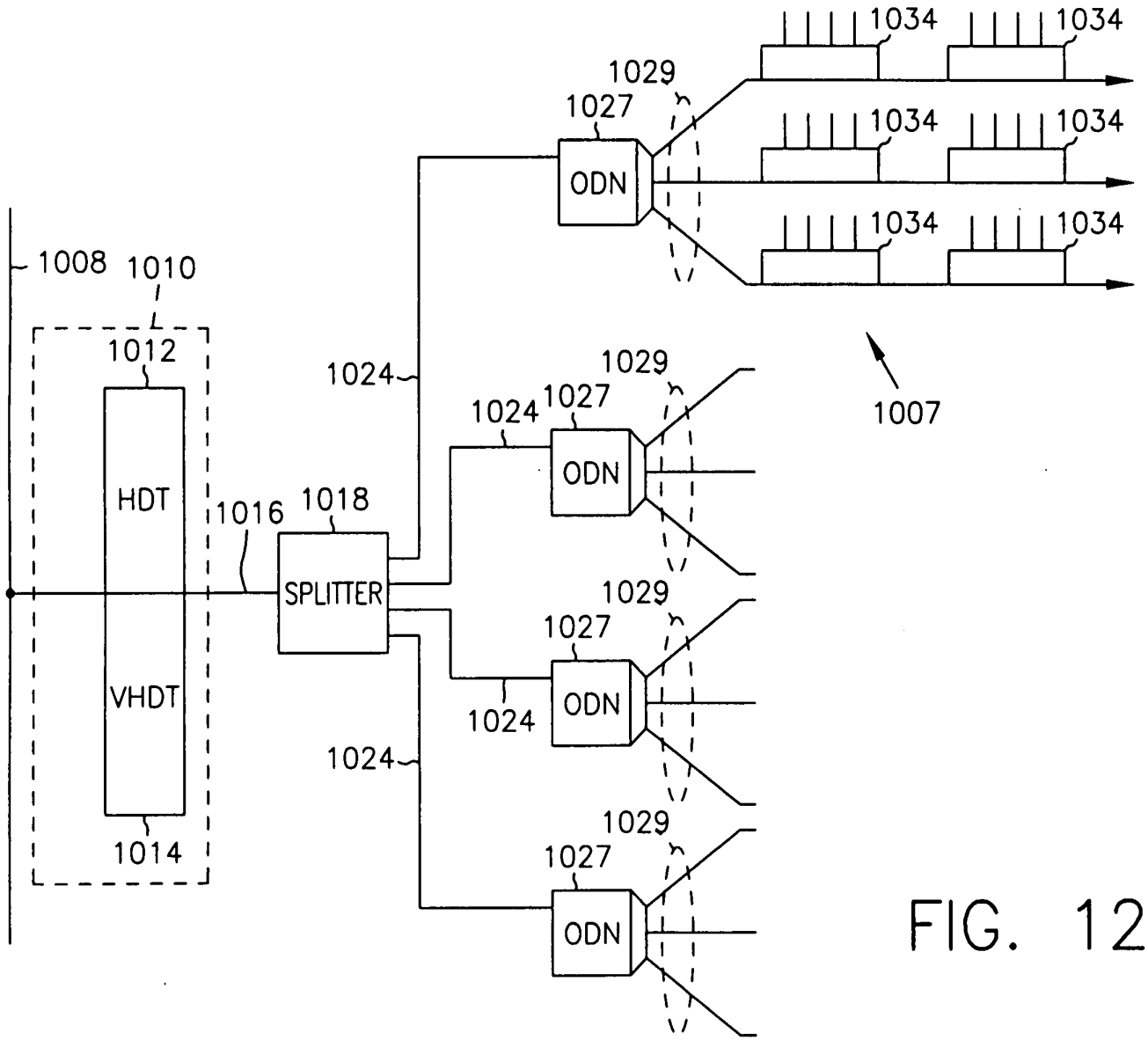


FIG. 120

T06020"h2ET0660

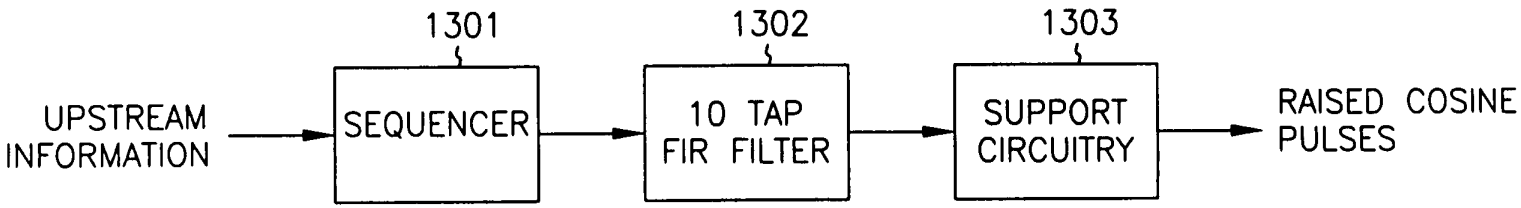


FIG. 121

T06020"h2ET066D

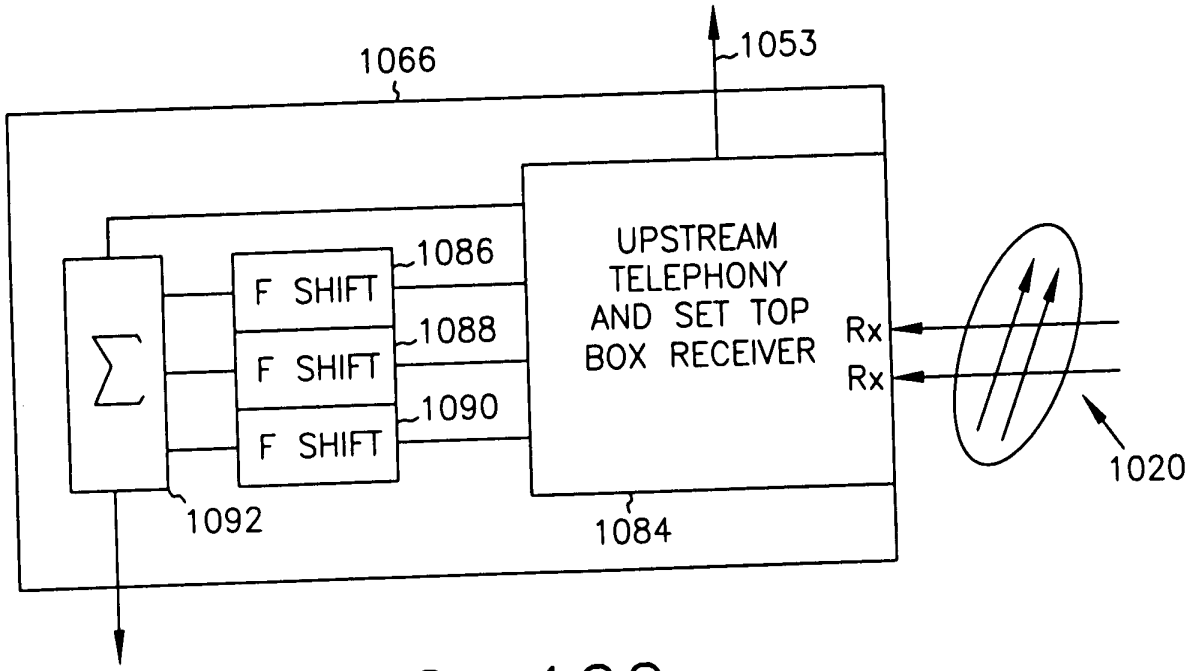


FIG. 122

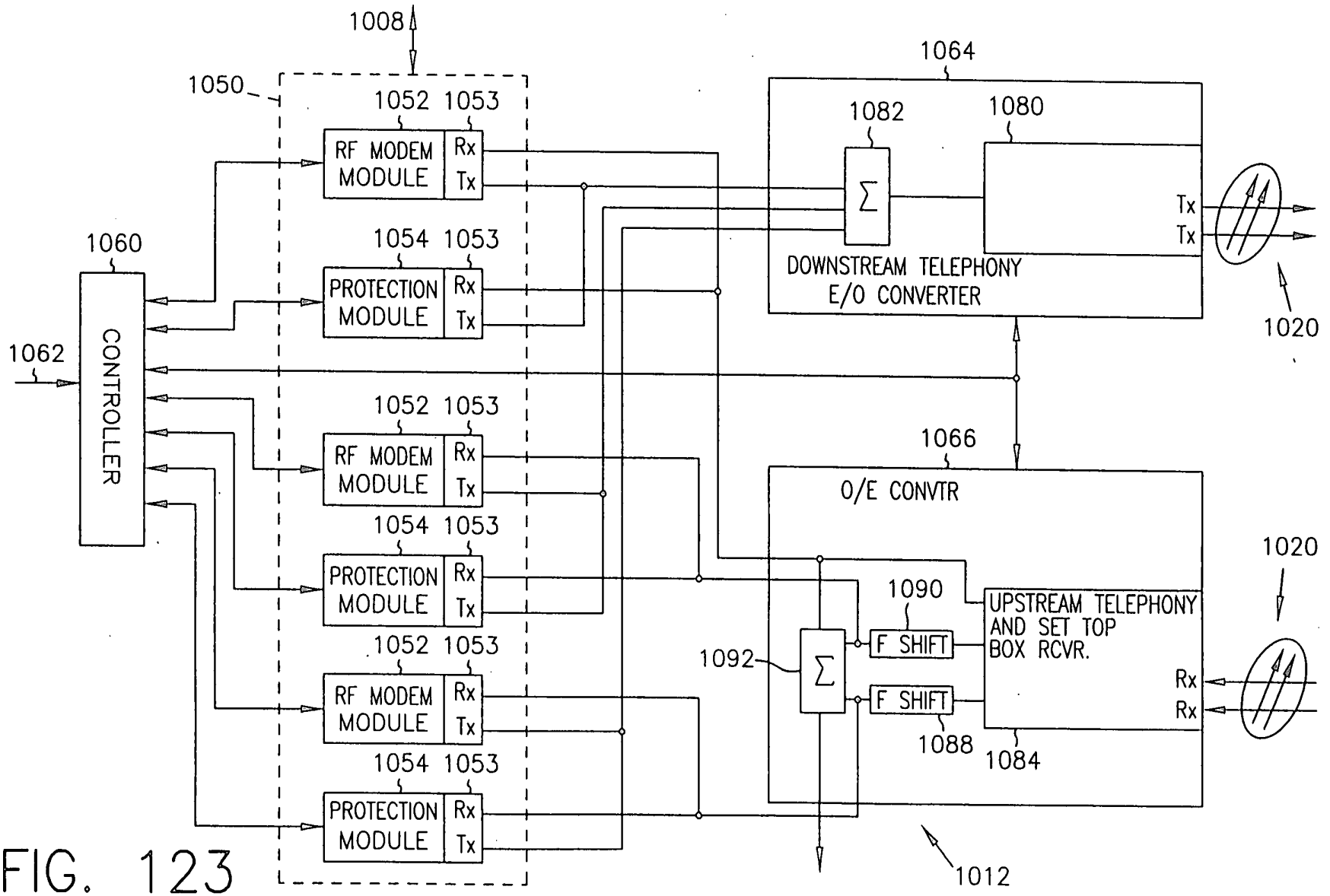

1008
1050
1052 1053
RF MODEM MODULE
Rx
Tx
1054 1053
PROTECTION MODULE
1060
CONTROLLER
1062
1064
1082
1080
Σ
DOWNSTREAM TELEPHONY E/O CONVERTER
Tx
Tx
1020
1066
O/E CONVTR
1090
F SHIFT
1092
UPSTREAM TELEPHONY AND SET TOP BOX RCVR.
Rx
Rx
1088
1084
1012

FIG. 123